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JOHN A. PARKHURST.

By STORRS B. BARRETT.

"There are a thousand wrong ways of doing a thing, and only one right way." Those who knew him best will recall with a smile this occasional comment of Professor Parkhurst's. It was the keynote of his character. To the limit of his ability he strove to find the one right way, and when satisfied that he had found it, that was the way the thing was done so far as he was concerned. This trait was manifest in his daily work. His note-books are models of neatness and accuracy, his card indexes are comprehensive, his papers, concise and lucid. He could hardly be drawn into giving an opinion not backed by previous careful consideration.

This passion for accuracy and precision was marked also in his avocations, which might be said to consist solely of church activities and motoring. Rather than see a piece of work in church or Sunday school poorly done he would undertake it himself and take infinite pains in the doing thereof. His car was spotless; it was driven steadily at twenty miles an hour with an occasional spurt on a good road; the springs never squeaked, the radiator never froze, the gas never gave out on a lonely stretch, the engine never stalled; and the car was a "consecrated" one, at the service of the whole neighborhood. When he traded it in for the current model (his one extravagance), all the countryside was eager to buy his old car, knowing full well that it had only improved under his careful driving.

This same steadfastness in guiding his course according to the dictates of his reason was noticeable in the daily routine; his diet was a simple and a peculiar one, not well adapted to dinner parties, but did one of his friends ever persuade him to deviate one jot or tittle from his self-prescribed regimen! Go to dinners he would, but with him went the inevitable little package of approved dessert to be laid at his plate. No blandishment, no pleading, no scoffing, could weaken him.

Somewhere in a boyhood of ill-health, perhaps during those years on crutches while suffering from a tuberculous ankle, one likes to imagine that this quiet lad had thought things through, had seen that life held little for him if he wasted his resources as did his companions, and had forthwith marked out a course for himself from which he never afterward departed.

John Adelbert Parkhurst was born September 24, 1861, to Sanford

and Clara J. (Hubbard) Parkhurst, at Dixon, Illinois. Upon the death of his mother when he was five years old, he was adopted by Dr. and Mrs. Abner Hagar, his uncle and aunt, who lived in Marengo, Illinois. Here he prepared for college in the public schools, and entered Wheaton College in the fall of 1880. After his sophomore year there was a year of teaching in the public school of Lombard, Illinois; then three years at Rose Polytechnic Institute, graduating in 1886 with the degree of B. S. in mechanical engineering. In 1897, the degree of M. S. was given him. In 1906, Wheaton College conferred upon him the degree of A. B. as of the class of 1885.

Upon being graduated from Rose Polytechnic, he became Instructor in mathematics there and remained two years until the death of his uncle made necessary his return to Marengo. In 1888, he had married Anna Greenleaf, of Terre Haute. They had one child, born in 1901, who died in infancy.

In the meantime his interest in astronomy had been growing. It was first stimulated by reading Thomas Dick's Works, books that have inspired many others, notably Professor Barnard, with a desire to know the stars. During his stay at Rose he had bought a small lens and had constructed a tube for it. This telescope is still in use as a finder on the six-inch reflector which he purchased during his stay in Marengo. Although largely occupied with business cares during his ten years at Marengo, he found time to begin serious work with his telescope, giving his attention mainly to variable stars. Apparently his first paper on Astronomy was published in *Astronomy and Astrophysics* for 1893. It was followed in the next ten years by a steady stream of brief communications, fifty in number, appearing in POPULAR ASTRONOMY, in the *Astronomical Journal*, and in the *Astronomische Nachrichten*.

His opportunity to devote more of his energies to astronomy came with the opening of the Yerkes Observatory within a few miles of his home in the fall of 1897. During the summer of 1898 he was appointed a volunteer research assistant and was given certain nights with the 12-inch refractor. At this period he divided his time between home and the Observatory, often driving a horse the intervening twenty-five miles, as the railway connections were poor. In 1900 he was appointed assistant and from this time devoted himself wholly to his chosen field.

His first work was a collaboration with George E. Hale and Ferdinand Ellerman on "The Spectra of Stars of Secchi's Fourth Type." The work was published as a part of Volume II of the *Publications of the Yerkes Observatory*. It formed also a part of Volume VIII of the *Decennial Publications* of the University of Chicago.

His first few years at the Observatory had been made possible by special grants to the Observatory, among them, one from the Carnegie Institution of Washington. In 1906 the Institution published his "Researches in Stellar Photometry during the Years 1894 to 1906, made chiefly at the Yerkes Observatory," a quarto volume of 192 pages.

Upon the termination of this grant, Mr. Parkhurst became a permanent member of the staff with the rank of Instructor in the University of Chicago; he was given an assistant professorship in 1912, and became Associate Professor of Practical Astronomy in 1919.

Another important paper was entitled Yerkes Actinometry. It was published in the *Astrophysical Journal* in 1912, and contained his measures of all stars to magnitude 7.5 between the north pole and 73° north declination for the determination of photographic and visual magnitudes, color indices, and spectral classes.

In a coöperative undertaking by the observatories of Harvard, Virginia, Lick, and Yerkes to compare the brightness of faint stars with the brighter ones whose magnitudes were already well established, Mr. Parkhurst represented Yerkes, beginning the work in 1900 on the measurement of the visual brightness of stars in twenty-four parts of the sky selected from the Rumford fields. This work was financed in the beginning by an appropriation from the Rumford Fund, the results being finally published in 1923 as No. IV of Volume XIV of the *Memoirs of the American Academy of Arts and Sciences.* The fine photographs of the 36 Rumford Fields published in this volume were the work of Mr. Parkhurst.

Mr. Parkhurst also collaborated, together with Professor Anne S. Young, with the Director of the Vatican Observatory, Father J. G. Hagen, in the preparation of No. XII of the Appendix to his atlas of the variable stars.

A participant in three solar eclipse expeditions in his later years, he was fortunate in finding a clear sky at the time of totality in only one, that of January 24 of this year. The first two expeditions were those sent out by the Yerkes Observatory to Green River, Wyoming, in June, 1918, and to Catalina Island, in September, 1923. On such occasions, when the result of weeks of preparation culminates in a single, precious minute or two, a moment not to be postponed by a second, nor to be prolonged nor repeated,—at this supreme moment, when men's nerves often fail them and they forget to uncap their lenses or to draw the slides of their plate holders, or start on their program too early or too late, or not at all,—no one who knew Mr. Parkhurst had the least fear that he would not be ready, his instruments tuned to the occasion, with every detail prearranged, every contingency provided for. When clouds interfered he was not vociferous; the instruments were dismantled, checked up, sent home, re-checked, and that was all,—until next time. On that bitter sub-zero morning of January 24 at Cornell his opportunity came at last, and he made the most of it. Returning home he showed us, with characteristic dry humor, what he declared was all the record he obtained. It was a small white card, absolutely blank. We were disappointed of course for we knew it had been clear at Ithaca. Our other observers, situated elsewhere along the line of totality, had met with clouds, and it seemed as if the hard luck of the Yerkes eclipse expeditions, unbroken since Barnard's trip half way

around the world to Sumatra in 1901, only to be mocked by dense clouds at the crucial moment, still spread its pall over our efforts. But a closer inspection revealed on the card a dozen or more tiny pin-pricks, the record of his successful measures of the brightness of the corona!

Since he began his connection with the Yerkes Observatory in 1900, Mr. Parkhurst had published, in addition to the works already mentioned, an average of about one major and one minor article, and one review, each year. There remains unfinished an important research on the determination of the photographic magnitudes and color indices of 1500 stars included in twenty-four fields of stars chosen by the late Professor Kapteyn and designated by his name as Kapteyn Fields. But all the observations have been made, the preliminary reductions have been completed, and the research will eventually be printed.

Of those who came to the Yerkes Observatory as candidates for higher degrees, a large proportion took their major subjects under him. They found him an instructor with thorough knowledge of his subject and with unusual ability to impart this knowledge. In addition, he was a skilled manipulator of the delicate apparatus necessary to his specialty.

Poorly equipped physically, he was able, nevertheless, because of excellent discipline of body and mind, to do more than a man's full quota, even though much of it was night work of an exhausting nature. Few moments were wasted by him; an extended vacation was seldom indulged in. The longest, six months, was spent with Mrs. Parkhurst in Europe, mostly in study at the Potsdam Observatory. Another vacation found the Parkhursts in Florida, but here again he had taken his computations with him.

Mr. Parkhurst had been for many years a member of the Royal Astronomical Society, of the British Astronomical Society, of the Astronomische Gesellschaft, and of the American Astronomical Society. He had represented his village for two years on the county board of supervisors, and had been active in all good works of his community.

Mr. Parkhurst was taken suddenly ill with cerebral hemorrhage on the morning of February 27, and died at his home on March 1. After a simple service, a fitting close to his well-ordered and blameless life, his body was taken to Milwaukee for cremation, by those who had known and loved him longest.

YERKES ECLIPSE EXPEDITION AT ITHACA, NEW YORK.

By J. A. PARKHURST.

It was planned to use at this eclipse the same photometric outfit which had been ready for the 1918 and the 1923 eclipses, consisting of a Hartmann microphotometer and standard incandescent lamp arranged for visual comparison of the total light of the corona with the lamp which had been calibrated at the Eastman Research Laboratory. Mrs. Parkhurst and I reached Ithaca Jan. 20, and by the kindness of Professor Ernest Merritt, head of the Department of Physics, and of Professor A. R. Riddle, of the Photographic Department, an east window was found on the third floor of Rockefeller Hall with an unobstructed view in the direction of totality. The orientation of the building was determined by the Civil Engineering Department, and the direction of totality was partly checked by a glimpse of the sun in the finder at the computed time of total phase, $9^h\,9^m$ E. S. T., on the morning of Jan. 22.

Friday, Jan. 23, was cloudy with a temperature of —3° F. Friday night and Saturday morning were partly clear, but the moving clouds disappeared from the part of the sky visible from our east window at $8^h\,42^m$ and were not seen again till after totality. There was a light breeze and the temperature was still at zero. The usual weird light preceded totality, which was reported as four seconds later than the prediction. Mrs. Parkhurst arranged the window and shades, closed the lamp circuit, read the ammeter and voltmeter, and counted audibly the 104 seconds of totality. I made three measures of the corona with a blue ocular filter, three with a green filter, three with no filter, followed by three measures of the light of the sky at a distance of 8° from the sun, with no filter. The light of the lamp shone through a blue filter, making a very satisfactory match with the color of the corona. Of the ocular filters the green gave the best color-match, and the three settings were correspondingly more accordant. The spectral absorption of these filters will be given in the later report.

Provisionally it can be stated that the corona plus the sky background appeared about three times as bright as a circle of the sky eight and a half degrees in diameter at a distance of eight degrees from the eclipsed sun; also that the corona was fainter than the February full moon.

It is a pleasure to acknowledge the kindness of the members of the Department of Physics at Cornell in aiding us to prepare for the eclipse, and our thanks are especially due to Professor Frederick Bedell and Mr. R. M. Holmes for many favors.

NOTE:—This was written by Mr. Parkhurst in the middle of February, about a fortnight before his death.

EXPEDITION FROM THE YERKES OBSERVATORY TO IRON MOUNTAIN, MICHIGAN.

By FRANK E. ROSS and OLIVER J. LEE.

The following equipment was set up on Pewabic Hill for observation of the eclipse on Jan. 24. Heavy clouds prevented all observations.

Photography of the Corona.

Four cameras were mounted on the equatorially driven "Sky Patrol" of the Yerkes Observatory: (1) a Clark doublet of 3.4 in. aperture and 20 in. focus, to be used with ordinary plates, without filter; (2) Zeiss apochromat of 2 in. aperture and 12 in. focus, for the infra-red with Eastman 88 filter and Eastman Kryptocyanin plate; (3) Zeiss Tessar of 3.5 in. aperture and 12 in. focus, using Eastman green monochromat filter No. 62, and isochromatic plates; (4) a quartz-fluorite lens of 20 mm aperture and 80 mm focus, to be used with lantern slide plates, and an Eastman No. 18 ultra-violet filter. Uniform exposures of 5 and 60 seconds were planned for all the cameras.

Photography of the Shadow Bands.

Four fast lenses, one "gunsight" $f = 1.5$ and three Kinostigmats $f = 2.0$, were mounted on a pivoted board to which was attached a pointer 10 feet long with which it was proposed to guide on the bands as seen on a white screen at a slightly larger distance from the cameras. The whole cabinet containing the cameras could be tilted 60° on each side of the normal position to effect parallelism with the bands, and clamped. The plan was to expose two Eastman Speedway plates at each of eight separate attempts to follow the bands with the pointer, giving exposures up to ¼ second.

Photometry of the Corona.

A special camera was made for photometering the corona in four spectral regions, namely, the violet and blue, the green, the red, and the infra-red. To effect this four single achromats of one inch aperture and four inches focus were mounted in a row in a camera box, each behind its appropriate color filter. The corresponding plates were placed 20 mm inside the foci, so that out-of-focus images, suitable for photometering, could be obtained. They were held in a common plate-holder. Calibration was to be effected on the full moon.

The citizens of Iron Mountain entertained us in the most hospitable fashion. The Rotary Club made all local arrangements and its members and others assisted us in every possible way.

Yerkes Observatory, February 4, 1925.

A DARK ENTERING WEDGE AT THE TERMINATOR OF MARS.

By G. H. HAMILTON.

In the December issue of POPULAR ASTRONOMY, Dr. Van Biesbroeck records a luminous extension at the terminator of Mars; and at the end of his notes concerning this phenomenon hopes that other observers in other localities may also have perceived it.

This extension, though interesting in itself, was not the most singular object at that time, but was simply an addition to the main occurrence.

I had already made a drawing on that night at $7^h\,45^m$ E. S. T., longitude of the center of the disk 216°, but saw nothing strange. A little after 8^h, while I was studying the disk, I suddenly saw—at least it impressed me as being sudden—a very definite break in the terminator, a jagged saw-toothed cut, in the vicinity of Hellas, just appearing from the unilluminated portion of the disk. At that time it may well have been over that region preceding Hellas, since the terminator side of the planet in that latitude was fairly bright, lacking in markings of note and desert-like in colour. This dark wedge was so definite and black—as dark as the night sky in the field—that my first thought was that it must be some optical trouble in the telescope.

Professor Pickering was in the house at that time and I asked my wife, who was with me, to have a look. She described the marking exactly as I saw it. I then called Professor Pickering and he proceeded to make a drawing. It was then that the bright protuberance was definitely noted by him. I had suspected it, but thought it a matter of contrast until he mentioned it.

The marking lasted from about $8^h\,18^m$ until $9^h\,58^m$, when my notes state, "slight cloud on Hellas near where dark wedge appeared earlier in the evening. This marking has now completely gone, though while seen it was as dark as the phase portion of Mars." My notes also say that it was still there at $9^h\,25^m$.

During the period between my first general drawing and my last, this phenomenon remained and while it lasted I was able to get three sketches of it on the terminator with rough drawings of the region near by.

It was found not to be a surface marking, since it remained on the terminator during the period of observation. As the three sketches show, the surface detail gradually appeared from under the markings as the planet revolved. For that day, at least, the marking travelled from approximately Hellas preceding to Hellas center, and at its disappearance left a small bright area—perhaps cloud—in its stead.

At first thought I took the dark marking to be the shadow of the

cloud-like protuberance but, as can be seen from the drawings, any shadow of this cloud could not be on the sunward side, and would in fact not be seen at all, since the shadow would miss the planet's surface altogether.

On October 23, with much better seeing, I was able to draw this same phenomenon, or a similar one, in about the same position in latitude as that of Dr. Van Biesbroeck's protuberances of the 27th. In this drawing there is no sign of the projection, but it may easily have been overlooked in my attempt to get the dark marking properly placed on a drawing with all the other surface features of the planet.

In all my drawings and sketches of it, I have shown this dark wedge and luminous extension farther south in latitude than that of the Yerkes. On October 20, my three drawings were made under poor conditions of seeing—ranging from 8 to 6 on the Pickering standard scale of 12, where anything lower than 6 in the scale of seeing is too poor to attempt observation. The fact of my first observations being made under these conditions shows how definite the marking was, to be able to stand out from the surrounding detail in the manner that it did. I was able to suspect a slight motion southward of the marking, but the detail that I was able to compare it with was too faint at the time to be thoroughly certain. At all events when seen again on October 23, under good conditions (Seeing 11 on same scale), the marking was much closer to the equator, and my next observation of it on October 27, the same day as that made at Yerkes, it was again much farther south.

This opens up the question as to whether it moved southward over a period of a few days, to again reappear and follow the same course along the terminator, or, since Dr. Van Biesbroeck seems to have seen another object, in a lower latitude and an hour later, it may be that there was a succession of these objects following each other southward. Mine being faint and far south at $13^h\ 15^m$ G. M. T. may have been at the end of its career, while that observed by Dr. Van Biesbroeck at $14^h\ 15^m$ an hour later and much farther north may have been a first appearance and, if it had been possible to follow it in the western sky for a sufficient time, might have reached the position in which I saw the other object.

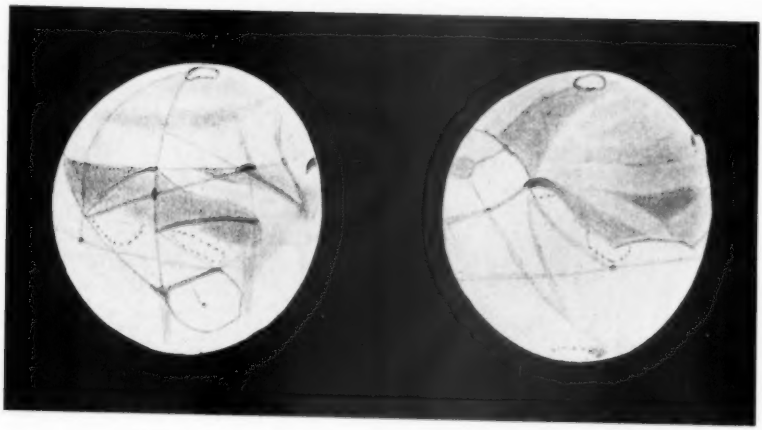
I am curious as to the reason that the entering wedge was not seen at Yerkes as it was seen here. The dark marking as seen there seems only to have been the division between the terminator proper and the luminous extension. In the case of the observations at Mandeville the dark marking extended appreciably into the illuminated disk, and surface detail was seen not only preceding it but north and south of it. The shape of this marking was also very distinct, appearing as a very accentuated "Beak of the Sirens," though farther south of course, and pointing in the same direction or nearly so as the "Beak" is often seen.

No matter what this marking may have been, it was seemingly limited to certain longitudes on the disk, as is evidenced from the fact that

PLATE XVIII.

October 20, 1924

$8^h\ 27^m$	$8^h\ 48^m$	$9^h\ 05^m$
Seeing 8	7	6



Oct. 23	Oct. 27
$9^h\ 50^m$	$8^h\ 15^m$
Seeing 11	7-8

DRAWINGS OF MARS BY G. H. HAMILTON AT MANDEVILLE, JAMAICA.

neither my first nor last drawing on October 20 showed any sign of it, though it was perfectly evident between those times. This of course is presupposing that there may have been a succession of these markings, as stated above. Since during the fairly long period I was able to observe on the 20th, without seeing a second object form to follow the first, I believe that the longitudes on the disk at the times of observation were not situated correctly with respect to the terminator to produce more than one that night.

Mandeville, Jamaica, B. W. I., February, 1925.

NOTE:—I have just received the *Monthly Notices* of the R. A. S. for December, and am very interested in the projection shown in a sketch by the Rev. T. E. R. Phillips, made on October 13, seven days previous to my observations of the 20th. I am sorry that I cannot reproduce it with my own, for it shows the same surface markings and the same region. Unfortunately I was unable to observe for some days before and after this date, so failed in seeing it at that time.

Mr. Phillips' description of it is very interesting; he says that he was able to see depressions on *both sides* of the protuberance.

These observations only go to show the importance of observing Mars from various well situated stations in different parts of the world. —G. H. H.

HARVARD ECLIPSE OBSERVATIONS ON JANUARY 24, 1925.

By EDWARD S. KING.

On account of the uncertainties of weather, which may render the best-planned eclipse expedition unproductive, the Harvard College Observatory has in the past engaged sparingly in this line of work. The proximity of the recent eclipse path, however, gave the opportunity of obtaining results of scientific value without great expenditure. A sketch of our activities follows.

Our chief aim was to measure the total light of the corona. For the purpose the form of coronal photometer, devised by the writer in 1918, was employed. Attempts by Miss Cannon to use this photometer at the eclipses of 1918 and 1923 were thwarted by clouds. For the present occasion four instruments of the sort were located at different points on the eclipse path; at Buffalo, Poughkeepsie, New London, and Nantucket. The wide distribution was, of course, to avoid clouds. All the photometers were exactly of the same pattern. Each instrument consists essentially of a wooden box, 57 cm long, with a circular aperture at one end. The opening, directed toward the corona, permitted the light to fall on the photographic plates at the lower end. In other words, it is a "pinhole" camera. By means of a pivoted cap, the area of sky covered was either three or six degrees in diameter. The light is received simultaneously on two different kinds of plates, one sensitive to blue, the other to yellow light. For the first, Cramer Hi-Speed plates were used; for the second, Cramer Isochromatic Instan-

taneous plates under a yellow filter. Shade glasses of two different densities are arranged to cover portions of both plates. In this way the coronal light could be photographed in two colors and three different intensities, six images in all at one exposure. After the eclipse different areas of the eclipse plates were exposed, in the same instruments, to a Hefner lamp for comparison. The exposures, both to the corona and to the standard lamp, were timed by metronomes kindly loaned by Professor W. R. Spalding of the music department of the university.

One of our stations suffered from clouds. This was at Buffalo where Dr. Shapley was located. Observations at Poughkeepsie by Miss Cannon, at New London by Mr. Campbell, and at Nantucket by the writer were made under a clear sky. Nearly 192 images were obtained during the total phase. The developed plates show comparable areas of measurable intensity, which should give integrated values for the corona both in blue and in yellow light, thus determining its color index. The plates from Buffalo should measure the darkness of the clouds obscuring the corona.

Clouds prevented Dr. Shapley from observing and announcing by radio the moment of second contact as planned. They interfered also with photography of the total phase. At Poughkeepsie, Miss Cannon saw the flash spectrum by means of a small replica grating used without a telescope. Mr. Campbell at New London noted a large coronal streamer to the northwest of the sun; also other, but shorter, streamers to the southwest and the southeast. Venus, Jupiter, and Mercury were first seen at $14^h\ 12^m\ 32^s$ G. C. T. According to observations made by Samuel Winram at New London, the moon's shadow was first seen in the west at $14^h\ 13^m\ 01^s$ G. C. T.; last seen in the east at $14^h\ 14^m\ 59^s$ G. C. T. The duration of totality probably coincided with these figures. Mr. Campbell records that at $14^h\ 16^m\ 32^s$ G. C. T. Mercury disappeared, and at $14^h\ 20^m\ 02^s$ Jupiter was barely visible. He describes also the shadow bands, seen on the snow, as moving from east to west. They seemed about two inches wide and about a foot apart.

At Nantucket, the Harvard party, consisting of Miss C. H. Payne and myself, coöperated with the Maria Mitchell Observatory. One of the six photographs of the eclipse, made with the Nantucket 7½-in. telescope by Miss Harwood, director of the observatory, was to determine the relative intensity of light distribution in the corona. A method was devised, by means of a Chapman-Jones plate-tester, to express the light intensity in terms of a Hefner lamp. Photographs, exposed to extra-focal star images, were obtained several nights before the eclipse, and similarly compared with the Hefner lamp. The relation between corona and stars is thus established. The method has the advantage that the comparison photographs may be made either before or after the eclipse, on nights of suitable clarity. It is hoped to obtain also, from these measures, a value for the earth-lit lunar disk. Miss Payne

assisted Miss Harwood by guiding the telescope through totality. She observed also the four contacts. The times, expressed in G. C. T., follow: (1) $13^h\ 04^m\ 25^s.1$; (2) $14^h\ 16^m\ 05^s.3$; (3) $14^h\ 17^m\ 34^s.3$; and (4) $15^h\ 35^m\ 51^s.7$.

Through the courtesy of Mr. C. F. Stiles of the Goertz American Optical Company, we obtained the loan of a quartz lens of about 24 cm focal length. The aperture is F/7.7. The front component is said to be of right-handed natural quartz, while the rear component is of left-handed quartz. One of the surfaces is so thickly silvered that no trace, even of the sun, is visible to the eye through it. The light transmitted, in the vicinity of $316\mu\mu$, gives a photograph of the sun in a second; of the moon in about a minute. This lens, fastened to Miss Harwood's telescope and operated by Mr. Alvin E. Paddock, was exposed for 65 seconds. The photograph obtained shows an interesting picture of prominences and the inner corona in ultra-violet light.

At all the Harvard stations an attempt was made to register the general illumination during totality by exposing bromide paper to the light of corona and sky, and comparing the darkening obtained with similar areas exposed to a Hefner lamp. These measures were largely vitiated by the excess of illumination which flooded the plate-holders used for the experiment. At Nantucket a plate under a Chapman-Jones plate-tester, exposed for 10 seconds, indicated general brightness in excess of the full moon. Measures and calibration of the plate-tester will give the exact figures. A 4-inch camera of the portrait type, which we took to Nantucket, was operated by Mr. Horace Marks. The four plates obtained, with exposures from two to ten seconds, show much detail and are corroborative of the visual observations of the coronal streamers. The light during totality appeared to me much brighter than I had previously experienced. The ground was covered with snow. The duration of totality was 89 seconds. It had been arranged so that an expeditious observer would not require much more than a minute for the program assigned. Thus, all engaged had, as a reward of quick action, at least a brief view of the spectacle. Mr. Marks was able to hold the corona in view for 10 or more seconds after the sunlight flashed out.

We observed the shadow bands before the total phase. They were about two inches wide and separated by about the same interval. Their direction was almost exactly parallel to the direct shadows cast by the sun. The rippling movement, as one faced the sun, appeared to be from left to right, that is, in the general direction northeast to southwest. The wind on the eclipse morning was from the north or northwest, with the thermometer about $+8°$ F. The same general trend of the shadow bands was observed at the other Harvard stations in the eclipse path. That the azimuth of the bands or waves was toward the sun appears significant.

Dr. Willard J. Fisher observed the eclipse near North Falmouth,

Mass. He gives the position as follows: Lat. 41° 39′.05 N; Long. 70° 37′.16 W. He records that the eclipse was not total; but that Baily's Beads were visible throughout the time of nearest approach. He was able to discern the complete circle of corona at mid-eclipse. He attempted photography of the shadow bands, but they proved too faint to show on development of the plates. The bands came from north or northeast "as fast as a man could run"; at mid-eclipse more slowly. Without regular shape or spacing, they appeared elongated across the direction of motion. The breeze came lightly from the northeast; temperature 0° F.

At Cambridge, Mr. P. R. Allen and Mr. R. N. Mayall observed the first and the last contacts with the 15-inch equatorial telescope, using the Innes method. Mr. Allen measured the chords of the indentation on the sun, while Mr. Mayall recorded the time. The provisional plotting of the measures gives the following values: First Contact, $13^h\ 04^m\ 07^s$ G. C. T.; Last Contact $15^h\ 35^m\ 23^s$ G. C. T. The computed times are $13^h\ 04^m\ 07^s$ and $15^h\ 35^m\ 45^s$ G. C. T., respectively. All the observations for the last contact had to be made through rather thick cloud which interfered seriously.

It was thought that some attempt should be made at Cambridge to obtain the flash spectrum with objective prism by photographing the cusp near mid-eclipse. Accordingly, Professor W. P. Gerrish and Mr. H. A. Sawyer used the 24-inch and the 16-inch telescopes, respectively, for this purpose. The intensity of the crescent, although partially occulted from the plate, fogged the film too much to give the results desired.

THIRTY-THIRD MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY.

(Continued from page 255.)

ABSTRACTS OF PAPERS

CHANGES IN THE VELOCITY OF ρ LEONIS.

By David W. Lee.

ρ Leonis was announced as a spectroscopic binary by Campbell in 1909 and afterward withdrawn.

Harper at Ottawa in 1912 found a range of 15 km in the radial velocity but no orbit was determined. His mean results were +10.0 km for the K line of calcium and +43.2 km for the hydrogen and helium lines. Dawson at the Observatory of the University of Michigan in 1914 obtained the values, +1.7 km for the K line and +41.1 km for the other lines.

Ten spectrograms of ρ Leonis made in 1923 at the Observatory of the University of Michigan give larger velocities than those previously

obtained. Seventeen of the best lines were selected for radial velocity determination, including hydrogen, helium, silicon, magnesium, carbon, and the K line of calcium, which was kept separate. The velocities vary from 50.5 km to 63.3 km, a range which is rather large for a star with constant velocity. The mean radial velocities determined are +28.2 km for the K line of calcium and +57.2 km for the other lines. This value of the mean radial velocity is 16 km greater than that found by Dawson and appears to indicate a real change in the radial velocity of the star.

TOTAL SOLAR ECLIPSE, 24 JANUARY 1925, FROM THE NAVY AIRSHIP "LOS ANGELES."

By F. B. Littell.

Eclipse observations from airplanes were proposed to the Naval Observatory by Col. John Millis, U. S. A., retired, in 1918, by Prof. D. P. Todd in 1919, and again by Col. John Millis in 1923. Some attempts were made in 1923, but no valuable results were secured. The proposal to observe the eclipse of 1925 from a Navy dirigible was made to the Naval Observatory by Col. Millis. The advantage of the dirigible over the airplane for the purpose is the steadier and larger platform for apparatus and observers. The disadvantage is the inability to ascend so high if necessary to over-ride clouds.

The main work of this expedition is to secure photographic registration of the features of the corona, and to get drawings. Attention will also be paid to color estimates, shadow bands, possible comets or other objects, and any other unusual appearances. The times of contacts will be noted. Spectroscopic observations will be made by a representative of the Bureau of Standards. The airship will be located near latitude +40°.7, west longitude 70°, that is, about 100 miles east of Montauk Point, over the Atlantic Ocean.

NOTE ON STELLAR VELOCITIES.

By W. J. Luyten.

It is now generally accepted that the solar motion, defined as the motion of the sun, relative to the centroid of the stars under consideration, is dependent on the mean absolute magnitude of the stars used. This result has generally been derived by discussing the stars in our catalogues, regardless of their distance. It seems of value therefore to investigate also the stars nearer than a given distance. In the present note we have considered the stars nearer than 25 parsecs, and selected the one hundred intrinsically brightest specimens with velocities under 66 km/sec.

To check the system of parallaxes used, the following comparison was made.

	Tangential Velocity.	Mean Radial.	Ratio.
Most certain parallaxes	21 km/sec.	17 km/sec.	1.24
Less certain parallaxes	24 "	14 "	1.71
All stars	22 "	15 "	1.49

Accidental peculiarities in the motions of these stars rather than systematic errors in the parallaxes seem to account for the discrepancy. The theoretical value for this ratio is 1.57.

Computing the three components of the space velocities, in the equatorial system, we find that their distribution follows more or less a normal error-curve with the constants:

for X mean	$= +1$ km/sec.	stand. dev. 11 km/sec.
Y	$= +13$	20
Z	$= -9$	15

The resulting solar motion is then:

$$A = 265° \pm 5°$$
$$D = +35° \pm 8°$$
$$V = 15.4 \text{ km/sec.} \pm 1.5 \text{ km/sec.}$$

Correcting therefor, and treating the residual X, Y, and Z components together, we obtain very nearly a normal distribution with a standard deviation of 16.5 ± 0.7 km/sec. or an arithmetic mean peculiar velocity of 13.2 ± 0.5 km/sec. This corresponds to a Maxwellian distribution of the space velocities with $h = 0.044$; the curve calculated with this value does fit the observations passably well.

The arithmetic mean space velocity is 26.4 km/sec., precisely twice the mean peculiar velocity. With a ratio of 1.17 between the solar motion and the mean parallactic velocity we should expect the uncorrected radial velocity to be 1.138 times the mean peculiar velocity. The observations yield 1.131. The wholesale tests for normality of the velocity distribution appear to be accurately satisfied.

It should be mentioned here that the seven stars belonging to the Ursa Major cluster had to be excluded in all computations. With respect to the centroid of the other stars used here they appear to be moving with a speed of 24.4 km/sec. to the point R.A. 284°, Dec. —2°.

As the conclusion from the foregoing considerations it may therefore be stated that the velocity law of the absolutely brighter stars in space, as tested by a small sample in the vicinity of the sun, is very nearly Maxwellian. Furthermore, that the motion of the sun relative to these stars appears to be directed toward the point R. A. 265°, Dec. +35°, with a speed of 15 km/sec.

THE RELATION OF TEMPERATURE TO CHANGES IN LEVEL OF THE OTTAWA MERIDIAN CIRCLE 1912-1922.

By R. J. McDiarmid.

The examination of the readings of level of the Ottawa meridian circle for the years 1912-1922, gave evidence of marked variations during certain seasons. The level of the Ottawa meridian circle is de-

termined by means of the mercury surface as a reflector and the Bohnenberger eyepiece. The mean of two level readings several hours apart usually constituted a determination. The graphical representation of the level readings for the ten year period showed that the variations were of a seasonal character, and could readily be divided into two groups. First group of variation less than 0.8 seconds of time and second group variation 1.5 to 2.8 seconds.

The second group, of large variation, it was found on the examination of the mean temperature curves, had a corresponding lower temperature. The seasons, from November to May 15, 1914-15, 1918-19, 1920-21, 1921-22 form group one, while 1913-14, 1915-16, 1916-17, 1917-18 and 1919-20 form group two. With the exception of the season 1915-16, the mean temperature of group two was about 4° C lower than for group one, and also the year of maximum change had the minimum temperature. In case of the larger seasonal variations the level never returned to the previous normal value, the difference depending on the amount of the variation. From 1912 to 1922 the telescope piers were tilted 4 seconds of time toward the east, that is, level was increased positively. Decided changes in temperature seemed to correspond with changes in level.

PECULIARITIES IN THE RADIAL VELOCITIES OF ALGOL.

By Dean B. McLaughlin.

In an eclipsing system in which the axis of the bright star is perpendicular to the orbital plane the rotation effect should be symmetrical with respect to the time of minimum light and should vanish at minimum. The rotation effect in Algol in 1923 vanished 25 minutes previous to light minimum. This cannot be explained as an effect of brightening of the forward face of the star by motion through a resisting medium or by librations symmetrical with respect to the periastron, and the form of the curve does not satisfy the hypothesis of an inclined axis at all.

A tentative explanation of this discrepancy as the result of blending of lines of the third body spectrum with those of the first body was tested in August, 1924, when the effect of blending should have been precisely reversed as compared with its value in 1923. The 1924 plates indicate a vanishing of the rotation effect either at or before minimum, but not after. The blend hypothesis must therefore be regarded as unconfirmed. If such blending exists it is masked by other effects. Both sets of plates agree in showing that the lines Hγ and Hδ are wider when the star is entering eclipse than when it is leaving. The variation of line widths and the asymmetry of the rotation effect may both be due to differing physical conditions on the front and back sides of the star. Velocities from helium and silicon lines show systematic departures from the mean of all lines. These may be attributed to the same cause.

The velocity of the center of mass of the eclipsing system in 1924 departs about 7 km from the curve of period 1.885 years, which satisfies all previous determinations very well indeed. It is suggested that the system may contain a fourth body about which the other three revolve in a very long period. The departures of all the Ann Arbor observations from the curve determined by Curtiss are in the positive direction and appear to increase with the time. This is in agreement with the velocities we should expect if the fourth body is one which would account for the long period term in Hellerich's formula for the times of minima. The evidence for the fourth body, however, cannot yet be regarded as conclusive.

THE ATMOSPHERE OF MARS.

By Donald H. Menzel.

The light which comes from a planet is made up of two parts, that from the atmosphere and that from the surface. Rayleigh scattering was assumed for the atmosphere. It was easily demonstrated that a gray planet (albedo constant for all wave-lengths) surrounded by such an atmosphere, would appear blue. The redness of Mars is conclusive proof that it has little atmosphere, its color being due to the selective reflection from the planet's surface.

An upper limit to the quantity of atmosphere on Mars was derived from the values of its visual and photographic albedos, 0.15 and 0.09 respectively. As no rocks are found in nature which completely absorb the ultra-violet it is possible to take not more than 0.05 as the atmospheric contribution to the photographic albedo—the remaining 0.04 being due to the surface. To produce this amount of scattering would require a quantity of atmosphere only about a fifth of our own. Under the reduced gravity of Mars the pressure at the surface, measured by an aneroid barometer, would be approximately 6 cm of mercury. This corresponds to a pressure in the terrestrial atmosphere at a height of ten miles above the surface.

The degree of redness of the Martian surface is equalled only by the very reddest of terrestrial rocks. A spectro-photometric study of such rocks as are found in the region of the Painted Desert would be of interest. It is concluded that the effect observed by Wright (*Publications of the Astronomical Society of the Pacific*, **36**, 239, 1924) cannot be attributed to atmosphere alone. Red rocks usually show much less contrast in the photographic than in the visual regions, which would account for the fading out of detail in the photographs taken in violet light.

PLANETARY TEMPERATURES DERIVED FROM RADIATION MEASUREMENTS USING RUSSELL'S FORMULA.

By D. H. Menzel, W. W. Coblentz, and C. O. Lampland.

This method was used in reducing the observations of 1922 as described in the *Astrophysical Journal*, **58**, 65, 1923. By this procedure the temperatures are derived from the fourth-power law of total radiation. The various factors, such as for example, the per cent transmission of the radiation which passes through the water-cell, the spectral transmission of the atmosphere, etc., enter as the fourth-root in the equation, and, hence, the errors of observation are minimized in the calculated temperatures. An uncertain factor, which enters into this method of calculation, is the albedo of the isolated areas upon which the observations were made.

The average temperature of the whole disk of Mars was —30° C. The temperatures of the bright areas on the apparent center of the disk range from —3 to +1° C. The temperatures of the closely adjacent dark areas range from +5 to +19° C,—the predominating observations being +10 to +14° C. The temperature of the south pole, as viewed through the overhanging mist was down to —60° C. But after the Martian solstice (October 5) the water-cell transmissions of the south polar region decreased from 60 to 30 per cent, indicating a marked rise in temperature, up to +12° C.

The temperatures derived by this method of reducing the data are in good agreement with those obtained by several other methods, all of which indicate conclusively that the equatorial temperature of Mars, when at perihelion, was considerably above 0° C.

The temperature of Jupiter was —135° C, Saturn —150° C, and Uranus less than —185° C. With the possible exception of Saturn, there is no evidence that these temperatures are maintained from any other source than the incident solar radiation. The effective temperature indicated for Venus is +60° C.

DISCOVERY OF BRIGHT LINE STARS OF CLASS B.

By Paul W. Merrill and Milton L. Humason.

Because Hα is the most intense bright line in stellar spectra of this type, we have made a partial spectrographic survey of the northern Milky Way, using the red portion of the spectrum. The Mount Wilson 10-inch refractor with 15° objective prism was employed.

Within the areas observed by us 60 bright-line stars of class B were previously known, and 80 additional ones have been found on our plates. The Harvard spectrographic survey showed 49 bright-line stars in the same areas. The large number of stars found by us is probably due principally to the fact that we have used the Hα line in-

stead of the less intense Hβ line employed by other observers. The question arises, however, whether some of our additional stars are not ones in which the bright hydrogen lines have come into existence or at least have become more intense since the epoch of the earlier observations.

MOTION IN THE SUN'S ATMOSPHERE.

By John A. Miller and Ross W. Marriott.

When making a detailed study of the large scale photographs of the corona made by the Sproul Observatory eclipse expedition at Yerbanis, Mexico, during the total solar eclipse of September 10, 1923, a number of peculiar formations in the coronal structure were observed.

On the southwest limb of the sun there is a region extending from 30° to 37° south of the sun's equator which shows marked activity. In this region the coronal structure is very complex, consisting of a series of interlaced arches. If a line be drawn from the center of the sun through the vertices of the central series of arches, the line curves noticeably towards the equator.

The arches on the 1923 eclipse plates differ in several essential features from the arches so prevalent on the eclipse plates of 1918, one of the principal features of the 1923 arches being that they are not surrounding eruptive prominences.

A study of the 1923 plates in connection with the K_2 images of the sun made at Mount Wilson Observatory on September 8, 9, and 10, 1923, leave little doubt but that the arches shown on the 1923 eclipse plates are intimately connected with the sun-spots on the solar surface.

Measures made on the plates made at Yerbanis, and on glass positives from the plates of Professor Douglass made at Puerta Libertad 24 minutes earlier, indicate that the material in the arches is receding from the center of the sun at a velocity of about 4½ miles per second.

Directly over the coronal arches there is a large cloud of matter, irregular in shape, which apparently had its origin in the disturbed region. There are a number of well defined condensations in this cloud, which can be identified on the two series of plates. Measures made on these condensations show that the cloud is moving outward from the sun's center, and also drifting toward the equator. The resultant velocity is about 28 miles per second.

In the immediate vicinity of both poles of the sun, there is in addition to the usual polar rays a sheet of light which appears to come up, either in front of, or behind the sun from a lower altitude. The southern sheet extends from 13° west of the projection of solar axis to 9° east of it. The margin of the sheet is sharp and definite, and extends ½ sun's radius below the southern limb of the sun.

The northern sheet extends from the projection of the solar axis to 25° west of it. The upper margin extends 1/3 sun's radius above the

northern limb of the sun, and is broken up with well defined markings. A great number of measures were made on the Sproul and Douglass plates. Twenty of twenty-two determinations showed a positive effect for Douglass—Sproul, and if we assume the sheet is behind the sun, indicates a rotation of the corona in the same direction and of the same order of magnitude as that of the sun.

TEMPERATURE OF THE PLANET MERCURY FROM RADIATION MEASUREMENTS.

By Edison Pettit and Seth B. Nicholson.

Measurements on the radiation from the planet Mercury have been made with the vacuum thermocouple attached to the 100-inch telescope between June 17, 1923, and November 21, 1924. These observations have been carried out on 21 days distributed fairly uniformly over this period. Each observation consists of a measurement of the radiation from the planet, and its transmission through a water cell, cover glass and fluorite plate. In this way five spectral regions are separated as in other measurements of planetary radiation. A set of deflections from the radiation from a star of known radiometric magnitude, and a reading of the psychrometer complete the observational data.

The radiometric magnitude of the planet at phase angle 90° and mean distance from the sun is —3.0 for average atmospheric conditions. At this time the total planetary radiation between 1.3μ and 14μ is about ninety per cent of the whole.

The temperature of Mercury has been computed from the spectral distribution of energy in the bands 1.3μ to 5.5μ and 8μ to 14μ. The ratio of the energy in these bands varies fairly rapidly with the temperature, but this is not the case with the bands 8μ to 11μ and 11μ to 14μ which can be separated by the fluorite window. The distribution in this region can be used only as a check on the results.

Black-body curves were drawn for various temperatures from 750° K to 250° K and Fowle's transmission constants for mean precipitable water on Mount Wilson together with the transmission of the apparatus applied. The ratios of the 1.3μ to 5.5μ band and 8μ to 14μ band were then taken. These were plotted against the temperatures.

In order to reduce the observed ratios to mean precipitable water they were plotted against the observed precipitable water and the mean line drawn. This curve was then applied to each observation and the ratios thus reduced to the value of the precipitable water used in the curve obtained from Fowle's data. From these corrected ratios the temperatures were read from this curve. These observed temperatures were then reduced to the values they would have if the planet were at its mean distance from the sun, by applying the inverse square law to the fourth powers of the temperatures. These corrected temperatures were then plotted against the phase angle.

This plot of temperature against phase-angle approximates the form of the curve of distribution of energy over the planet's surface, which can be computed from the assumption that the radiated energy is a constant fraction of that received from the sun at any point. Under these conditions the temperature of the planet at full phase is 690° K, at phase-angle 90° it is 600° K, while at the greatest phase-angle at which we have observed, 120°, it is 500° K.

From the radiometric magnitude of the planet we can compute the total radiation from that part transmitted by the 8μ to 14μ band in our atmosphere. Temperatures determined by this method are only 20° lower than those determind by the first method at full phase, but the disparity increases with the phase-angle, becoming 120° at phase-angle 120°. This can possibly be explained by the hypothesis of shadows.

The radiation from a planet at any phase comes from points of very different temperatures, and the atmospheric corrections will be different for these points. Temperatures computed from the total radiation probably represent the temperature of the mean radiation over the illuminated surface more closely than those computed by the ratio of the bands.

If we take the mean value then, the temperature at full phase will be 685° K and the maximum values on the planet at mean distance would be 30° or 40° higher than this. Assuming that the radiation from the sun is equivalent in rate to that radiated by a body at 6500° K, the maximum temperature on a non-conducting black body at Mercury's mean distance would be 710° K. Since the observed value agrees with this, and the maximum assignable value of the sun's temperature has been used, it is probable that Mercury acts nearly as a black body. Indeed we have other evidence of this, since from the water-cell and atmospheric transmission we find that the reflected light is only about 3 per cent of the emitted radiation, and therefore of the incident light if Mercury has no internal heat.

Attempts to measure the radiation from the dark side of the planet have thus far shown that this radiation is very small if it exists at all, and hence radiation of internal heat must be negligible.

ξ PERSEI, A DEVIATION FROM ELLIPTIC MOTION.

By W. Carl Rufus.

The orbit of ξ Persei was determined by Cannon of Ottawa in 1912 from the displacements of the H and K lines of calcium. The period was 6.951 days and the semi-amplitude, 7.87 km. The peculiar distribution of his normal-place velocity residuals with respect to phase is here noted.

Residuals with values of —2.57, +4.65, —3.22 and +3.26 km respectively, occur at phases 0.472, 1.322, 5.123 and 5.803 days. As

the mean absolute value of these residuals is nearly one-half the semi-amplitude of the velocity-curve, their reality can scarcely be questioned. Correlating these large residuals with orbital motion, it is seen that the first one, which occurs soon after the velocity of approach begins, indicates that the observed velocity toward the observer is greater than the foreshortened line-of-sight component of orbital motion. The second, which occurs near the maximum velocity of approach, indicates that the observed velocity is not as great as required by orbital motion. The third and fourth show corresponding differences in the velocities of recession.

Preliminary work based upon 100 spectrograms of ξ Persei made at the Observatory of the University of Michigan gives additional evidence that the assumption of elliptic motion is insufficient to explain the line displacements and other spectral features. Separate velocity-curves based upon the isolation of the lines of hydrogen and helium, in addition to calcium, present differences in amplitude, form and phase, which necessitate large supplementary causes or an abandonment of the binary hypothesis to explain the measured displacements. Changes in the relative intensities and in the appearance of the spectral lines are also frequent and complex. At times the broad and diffuse lines have well-defined nuclei. When two are present a semblance of doubling results. Occasionally three or more are suspected. On one plate four such features were measured with separations nearly equal and averaging 2.8 A, occupying the position of the broad helium line at λ4713.

Variable radial velocity appears to be a characteristic of stars of spectral class Oe5 to which ξ Persei belongs. The validity of the binary hypothesis to explain the entire class, presumably representing a stage of stellar evolution, is here questioned. The notable absence of eclipsing binaries of this class and the very rare occurrence of evidence of two sets of spectral lines do not support the hypothesis. The present stage of the problem of ξ Persei favors the assumption of disturbances producing effects in the atmosphere of the star.

IMPROVEMENTS IN TIME DISTRIBUTION.

By Paul Sollenberger.

When the telegraph was the only means of time signal transmission, it was not ordinarily possible to use the signals for highly accurate scientific purposes, owing to the uncertain lags of the telegraphic relays. With the advent of radio it was believed that results of considerable precision ought to be achieved. However the first international time signal comparisons revealed the fact that large and somewhat surprising differences existed in the signals, differences sometimes amounting to several tenths of a second. Being one of the world's chief distributors of time, the U. S. Naval Observatory has been and

is still engaging in investigations with a view to reducing these discrepancies.

In the last few years new and more accurate means of making astronomical observations for time have been developed, and the methods of reducing time observations have been revised. Apparatus has been devised for measuring the time required for the operation of radio stations during each signal. Work in making more uniform the ticks as they leave the Observatory, in making more highly accurate the means for measuring the times of these ticks, and in making more uniform the lags of the transmitting stations remains to be completed. Efforts are made to measure the signal times to the nearest thousandth of a second.

While a large number of radio stations transmit time signals for commercial purposes, emphasis should be laid on the fact that the only stations emitting signals under complete check at the Naval Observatory are Annapolis and Arlington, and they are therefore the only American stations which should be used for scientific purposes. Many astronomers in Australia and the orient have requested that a scientific time signal be established in the Pacific. The Naval Observatory has conducted experiments with a view to finding satisfactory means for the establishment of such a signal.

Realizing the importance of accuracy in this matter, not only in astronomical problems, but also in important geodetic work, the personnel of the Naval Observatory is always glad to coöperate with all others who may be interested in the question.

ON SOME NEW VARIABLE STARS.

By Joel Stebbins.

This paper gives a report of progress on further improvements in photo-electric photometry, it being now possible to measure stars of the seventh magnitude with a 15-inch refractor. The observations on several objects have been completed, and a new eclipsing variable is the spectroscopic binary, Boss 5070. This star of spectrum B3 has a period of 12.4 days, eccentricity 0.2, and there are primary and secondary minima, the total variation being about 0.15 magnitude.

PHYSICAL THEORY OF METEORS.

By C. M. Sparrow.

By considering the first heating of the meteor to be due to direct impacts of the air molecules on a solid nucleus, and that the height of appearance is determined by the temperature of copious evaporation, a theory is developed which gives good agreement with observation without requiring any essential modification of accepted ideas regarding the temperature, pressure or constitution of the upper air.

THE EFFECT OF TEMPERATURE GRADIENT ON THE INTENSITIES OF FRAUNHOFER LINES.

By John Q. Stewart.

A theoretical study of the factors which influence line-intensities in stellar spectra. The Fowler-Milne treatment applies in strictness to Fraunhofer lines produced by a constant mass of homogeneous gas at any given temperature and pressure, and selectively opaque to radiation from a much hotter body underlying it. In the present paper this treatment is refined to take account of the temperature-gradient in a stellar reversing-layer and the gradual transition from reversing-layer to photosphere.

Selective opacity, to which are due the Fraunhofer lines, is per reacting atom—at any rate to a first approximation—independent of temperature and density; since selective opacity is due to processes peculiar to the individual molecules concerned. General opacity, on the other hand, depends upon mutual influences between molecule and molecule, particularly upon near approaches and collisions of molecules, and thus increases with temperature and density. Furthermore the quantity of material above the photosphere decreases as the general opacity increases; while low selective opacity results in the formation of a Fraunhofer line in the comparatively low, hot region near the photosphere.

Qualitative application of these considerations to stellar conditions affords an explanation, in part at least, of (1) the well-known increase of blackness and sharpness of lines in the spectra of giants, as compared with lines in the spectra of dwarfs; (2) a displacement toward lower temperatures of the maxima of line intensity indicated by the unmodified Fowler-Milne equations, in the giant series M-B. Such a displacement has been found by D. H. Menzel (*Harvard Observatory Circular* No. 258, 1924).

The first of these phenomena is explained by the conclusion that in a giant, owing to the small density, there is more material overlying the photosphere than in a dwarf having the same effective temperature; while at the same time the density in the photospheric region is less in the giant, owing to the low gravity. The second follows from the theoretical decrease with increasing temperature and density in the quantity of material overlying the photosphere. Thus the contrast between line and continuous background tends to become less along the giant series M-B (since, furthermore, for the same abundance of active material, a given line is formed always at the same depth); and this tendency, superimposed upon the change in abundance defined by the Fowler-Milne equations, results in the shifted maximum.

The matter of a more accurate definition of line-intensity, or line-conspicuousness, requires consideration. Intensity is a function of width and also of blackness, or contrast. The latter, on the simple theory, approaches saturation as the amount of active material high

above the photosphere is increased; the radiation in any line, on this view, should be no less than black-body radiation corresponding to the temperature of the outer limit of the reversing layer. Line-width, on the other hand, increases continually with the quantity of "absorbing" material, although not in direct proportion. Rayleigh scattering close to "resonance," or its quantum equivalent, affords, in many cases, an adequate explanation of this effect (Stewart, *Astrophysical Journal*, **59**, 30, 1924).

Finally, the importance of "fluorescence" is emphasized—the transfer of radiant energy, as the result of processes occurring within the atom, from one frequency to another—in arriving at a definitive theory of the formation of Fraunhofer lines. To this process doubtless may be ascribed the observed excess blackness of Fraunhofer lines in certain cases.

A GRAPHICAL METHOD FOR OBTAINING THE ELEMENTS OF THE ORBIT OF A VISUAL BINARY.

By R. Meldrum Stewart and F. Henroteau.

Having given the apparent ellipse and the position in it of the principal star, the direction of the line of nodes is given by the bisector of the exterior angle formed by joining the position of the principal star to the two foci of the apparent ellipse.[1] Then take any line AB parallel to the line of nodes, cutting the projections of the major and minor axes of the true ellipse in A and B respectively, and erect upon AB a semicircle, on the side toward the center of the ellipse. Draw through the center C a line perpendicular to the line of nodes, cutting AB in D and the semicircle in E. Find a point F in AB such that CF is equal to ED. Then the angle FCD is the inclination and the angle BAE is the angle between the line of nodes and the major axis, while if A has been chosen coincident with the projection of the end of the major axis, AE will be equal to the major semi-axis. The eccentricity is found, as in Zwier's method, from the ratio of the distance of the principal star from the centre to the length of the corresponding semi-diameter.

The proof of these relations is elementary, and may be obtained either geometrically or analytically. The description will be given in more detail in the *Publications of the Dominion Observatory*.

RADIO LONGITUDE DETERMINATIONS BY THE U. S. COAST AND GEODETIC SURVEY.

By Clarence H. Swick.

Since June, 1922, the U. S. Coast and Geodetic Survey has determined by radio the longitude of nearly thirty stations scattered over the

[1] It appears that this property has been previously described by B. Mlodzieiowski in Annales de l'Observatoire Moscou, II Serie, Tome 2, p. 168.

western part of this country and in southeastern Alaska. The observer on this work has used a new radio receiving device by means of which the Naval Observatory time signals, transmitted by the Annapolis radio station, are recorded accurately on a drum chronograph. The results compare very favorably with those obtained by the wire telegraph method, the probable errors averaging less than when the signals were transmitted by wire.

A great advantage of the radio method is its independence of telegraph lines. Stations can now be located on small islands or mountain peaks without any regard to the nearness of telegraph offices, and they can be made coincident with the triangulation stations and thus eliminate the difficulty and expense of the special connections which are often required when the telegraphic method is used.

THE HUSSEY DOUBLE STARS.

By G. Van Biesbroeck.

The list of more than 1300 new double stars that Hussey has announced as his share in the Lick Observatory survey of the northern sky, down to the ninth magnitude, has been re-observed at the Yerkes Observatory since 1917. This work is now completed except for a few objects that could not be seen in late years because they have probably closed in too much. Many of the Hussey stars have not otherwise been observed since their discovery. A discussion of the motions recorded after an interval of roughly 20 years has given the following results:

			Per Cent	
a)	Binaries	From curvature of orbit	2	33
		Common proper motion	14	
		Plausible value for hyp.	17	
b)	Fixed or doubtful change		63	
c)	Change of unknown character		3	
d)	Optical		1	
			100	

To the 33 per cent of stars that are certainly binaries, a large portion of the second group (pairs unappreciably changed after 20 years) will have to be added in the course of time, so that the percentage of physical pairs is very high.

Hypothetical parallaxes have been computed for 230 pairs showing enough motion, and used as a criterion for deciding if a pair is a physical or an optical double.

Slides illustrate the more interesting changes observed, and tentative elements computed for some of the pairs. The observations and their discussion will be published in detail in 1925.

A NEW TEMPERATURE RECORDER.

By C. B. Watts.

A device was recently designed and installed at the Naval Observatory which records the temperature of the clock vault at a convenient place in the main building. The apparatus in the vault comprises two large kerosene-mercury thermometers, into each of which a platinum wire is periodically lowered and withdrawn by clockwork. The recording apparatus has a pen moving above the paper in synchronism with the moving wires, and when the wires touch the surface of the mercury an electric circuit is closed which causes the pen to be pressed against the paper for an instant. By this means the temperature in the inner vault is recorded on a scale of one centimeter to a degree Centigrade.

ORBIT OF βGC 1036 = β 513.

(1950.0 α $1^h\,57^m\,49^s$ δ $+70°\,40'$)

By MAUDE BENNOT.

Computations for this orbit were made by both Burnham's modification of Ball's graphical method, described in Popular Astronomy, Vol. I, pp. 243, 349, and by Zwiers' graphical method, using the measures given in Burnham's General Catalogue of Double Stars and the following subsequent observations:

t	θ	ρ	n	Observer	Reference
1907.90	111°.2	0″.46	5	vanB	1
07.91	92.8	0.38	3	Doo	2
08.12	113.0	0.28	1	A	3
08.97	123.1	0.40	3	vanB	1
10.69	140.3	0.48	3	vanB	1
12.74	159.8	0.51	3	A	3
12.75	160.1	0.50	3	vanB	1
12.80	156.7	0.49	1	Fox	4
14.65	174.0	0.51	3	A	5
15.87	180.8	0.63	2	A	5
16.09	177.6	0.58	2	Fox	4
16.95	182.4	0.63	1	A	5
17.47	184.4	0.73	4	Com	6
17.90	187.9	0.66	3	A	5
20.11	200.9	0.55	1	Fox	4
21.69	202.3	0.69	2	A	5
25.01	220.1	0.72	5	Fox	4
25.10	223.1	0.75	1	Bennot	

References: 1. Van Biesbroeck (*Ann. Belgique Obs.*, 13); 2. Doolittle (*Pub. Flower Obs.*, IV); 3. Aitken (*Pub. Lick Obs.*, XII); 4. Fox (unpublished—to appear in *Ann. Dearborn Obs.*, II); 5. Aitken (*Bul. Lick Obs.*, 348); 6. Comstock (*Pub. Washburn Obs.*, X).

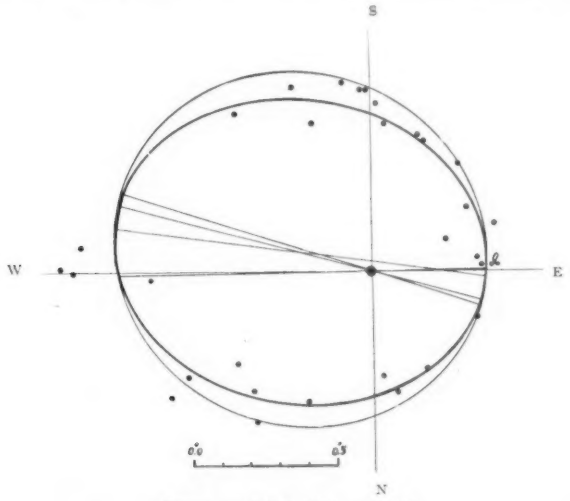
TRUE ORBIT.

P = 63.3 years
e = 0.385
a = 0".66
T = 1904.8
i = ±31°.5
Ω = 90°.5
ω = 341°.6

APPARENT ORBIT.

Length of Major Axis	1".30
Length of Minor Axis	1".22
Distance of Star from Center	0".25
Position Angle of Major Axis	82°.6
Position Angle of Periastron	74°.5

See's elements of this pair, given in Aitken's "Binary Stars," page 290, are not greatly dissimilar to those given above, except that his



ORBIT OF β GC 1036 = β 513.

period, 52.95 years, is considerably smaller. The larger period bears out Aitken's statement (*Pub. Lick Obs.*, XII), "It is probable that the period is somewhat longer than the value given by See." In *Bul. Lick Obs.*, 348, Aitken compares his measures with the positions computed from unpublished elements by Rabe. These elements are not available for comparison.

On the diagram are shown the apparent orbit in the heavier, inner curve; the true orbit in the lighter, outer curve; the line of nodes, almost coinciding with the diurnal circle; the major axis of the true orbit; its projection on the apparent orbit; and the major axis of the apparent orbit.

Dearborn Observatory, Northwestern University,
9 March 1925.

ORBIT OF βGC 8933 = β 648.

(1950.0 α 18^h 55^m 09^s δ +32° 50′)

By VERA M. GUSHEE and MARGARET L. FURREY.

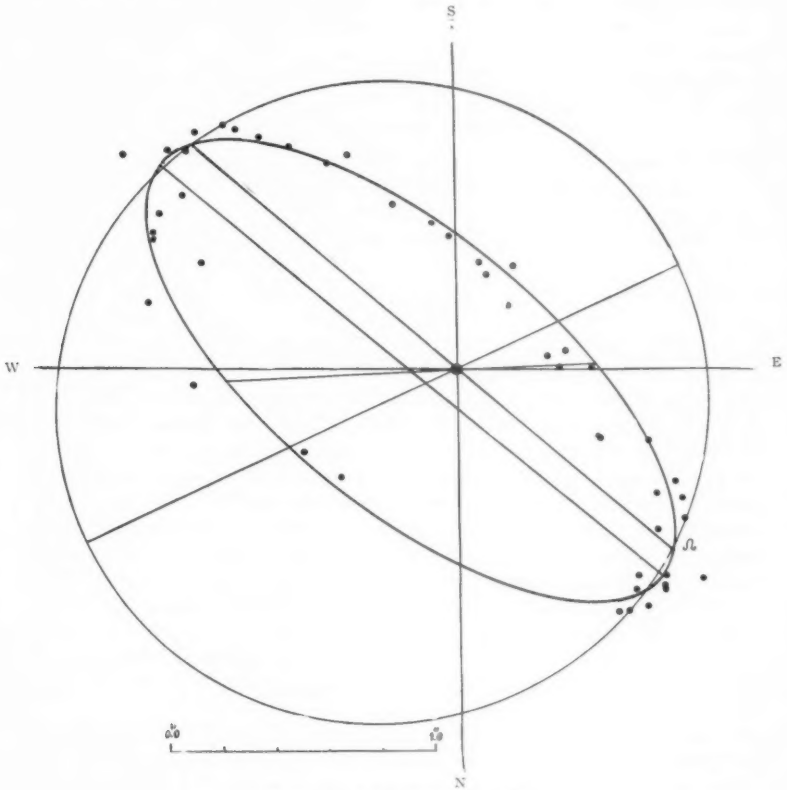
There are published orbits for this star by Lohse (*Pub. Potsdam Obs.*, 58); by Aitken (*Pub. Lick Obs.*, XII); and by Van den Bos (*B. A. N.*, 12), of which the first two were considered provisional.

The present computations were made from the observations listed in Burnham's General Catalogue of Double Stars and the following:

t	θ	ρ	n	Observer	Reference
1906.4	190°.2	0".58	7	A	1
06.5	189.7	0.47	1	Com	2
06.7	179.0	0.42	1	L	3
07.6	182.7	0.46	3	A	1
07.7	182.2	0.51	2	WB	3
08.4	167.4	0.41	2	vanB	4
08.7	163.2	0.37	9	A	1
09.6	150.3	0.45	2	vanB	4
09.7	140.3	0.31	3	A	1
11.5	98.4	0.35	3	A	1
11.5	99.7	0.42	4	vanB	4
12.6	80.5	0.52	9	A	1
12.7	76.9	0.55	1	Com	2
12.8	83.8	0.42	1	WB	3
13.7	64.2	0.60	3	WB	3
14.5	68.4	0.86	4	Fox	8
14.5	68.2	0.68	6	A	5
14.6	72.7	0.85	3	Com	2
15.7	62.8	0.97	3	Com	2
15.9	62.3	0.88	3	vanB	9
16.3	55.9	0.90	3	Fox	8
16.5	60.4	0.97	3	Brown	6
16.6	62.4	1.01	3	Com	2
16.7	56.8	0.80	7	A	5
17.6	58.0	1.06	3	Com	2
17.6	55.6	0.99	3	vanB	9
18.6	53.8	0.96	3	vanB	9
18.6	53.6	1.02	2	Com	2
18.6	49.2	0.95	6	A	5
19.5	47.9	1.04	3	A	5
19.6	51.3	1.24	3	Com	2
19.6	50.8	1.36	5	Lv	7
19.7	46.5	1.13	5	Lv	7
20.4	45.4	1.14	11	A	5
20.6	46.9	1.07	3	vanB	9
20.8	43.8	1.01	6	Lv	7
21.4	43.4	1.13	4	vB	11
21.7	37.3	1.07	5	Lv	7
21.8	39.6	1.07	9	A	5
22.7	43.7	1.10	3	vanB	9
23.6	41.1	1.03	3	vanB	9
24.6	35.2	1.12	3	vanB	9
24.7	33.2	1.09	1	A	10
25.1	35.8	1.05	2	Fox	8

References: 1. Aitken (*Pub. Lick Obs.*, XII); 2. Comstock (*Pub. Washburn Obs.*, X); 3. Lewis and Bowyer (*Greenwich Double Stars* 1893-1919);

4. Van Biesbroeck (*Ann. Belgique Obs.*, 13); 5. Aitken (*Bull. Lick Obs.*, 348); 6. F. L. Brown (*A. J.*, 703); 7. Leavenworth (*A. J.* 761, 787, 810); 8. Fox (Unpublished); 9. Van Biesbroeck (Unpublished); 10. Aitken (Unpublished); 11. Van den Bos (*B. A. N.*, 12).



Orbit of β GC 8933 = β 648.

The elements were computed by Zwiers' graphical method and are presented in tabular form together with those of earlier orbits computed by Lohse, Aitken, and Van den Bos.

	True Orbit.				
	Lohse (1906)	Aitken (1913)	Van den Bos (1922)	Furrey (1925)	Gushee (1925)
P	50.85 yr.	45.85 yr.	56.91 yr.	58.1 yr	57.0 yr.
e	0.436	0.305	0.227	0.25	0.20
a	1".22	1".04	1".247	1".24	1".24
T	1910.85	1914.15	1911.78	1912.1	1911.2
i	±66°.71	±62°.35	±66°.02	±64°.7	±65°.5
☊	42°.30	52°.5	50°.69	49°.7	48°.0
ω	65°.29	335°.7	293°.61	294°.5	285°.7

Apparent Orbit.	Aitken	Furrey	Gushee
Length of Major Axis	2".02	2".43	2".50
Length of Minor Axis	0.93	1.04	1.05
Distance of Star from Center	0.31	0.18	0.12
Position Angle of Major Axis	54°.2	50°.5	49°.0
Position Angle of Periastron	65.4	93.0	105.5

Dearborn Observatory, Northwestern University,
25 February 1925.

CLIMATIC CONDITIONS ON MARS.*

By W. W. COBLENTZ

I. Retrospect.

In looking back over the developments of the past 12 years in celestial radiometry it appears to me that this line of astrophysical investigation had a narrow escape from remaining unattempted for an indefinite time. It is true that the earlier radiometric work showed that heat from stars could be detected; but the mere fact that the indications of heat radiation were small seemed to cause astronomers to hesitate in making further attempts, especially by using large reflectors. Astronomical observatories are busy places. Reflecting telescopes of 60 inches or greater aperture are rare. The night hours of clear seeing are few, therefore every minute is allotted to problems that are promising of successful results. This was strongly impressed upon me when I first made inquiry for the use of a reflecting telescope and was advised that the work of large reflectors is too valuable to be interrupted for tests of a device which promised so little success, without further trial with a small reflector.

Fortunately for me and for science, the 36-inch Crossley reflector of the Lick Observatory became available in July, 1914, and the test of stellar thermocouple directly against stars[1] was delayed until that time.

The radiometric equipment was so small and fragile that it was carried in a hand-bag to the observatory. And because it was so simple, (probably also because of the general belief held up to that time, that the thermocouple cannot compete with the bolometer) as I learned afterwards it was freely predicted that "he won't get anything."

Looking back over these 12 years it is interesting to recall the mental attitude of the time. Astronomers going on expeditions are accustomed to seeing an immense array of equipment. Hence it was natural to

*Address prepared for the Brooklyn Institute of Arts and Sciences, February, 1925.

[1] Thermocouples for measuring heat from stars were constructed and tested in the laboratory in 1911; *Bu. Stand. Bul.*, **9**, p. 30, 1911; *Popular Astronomy*, **31**, p. 105, 1923.

wonder how anything so small that it could be transported in a handbag would be successful. But it was the very simplicity of the outfit that made it a success.

The story of the stellar radiometric tests of 1914 is briefly told. Weather conditions were favorable. Out of a possible 28 nights available for observations, 18 half-nights were devoted to stellar radiation measurements. During that time some 125 celestial objects were measured including 110 stars, some as faint as magnitude 6.7. Lack of endurance prevented us[2] from doing more.

The experimental procedure then employed, and the results obtained seem to have foreshadowed, in an unforeseen manner, practically everything that has been accomplished since then. It seems fortunate for science that a small reflector with many nights instead of a large reflector with a few nights became available for observation at that time. But it is equally fortunate for science that, in the meantime, these radiometric instruments, attached to the largest reflector now in existence can be devoted to this type of astrophysical investigation.

In the summer of 1921 the Lowell Observatory extended me the privilege of using the 40-inch reflector for testing instruments for measuring stellar spectral radiation and stellar temperatures. In 1922 some measurements were made of planetary radiation, especially of Mars, preliminary to the measurements of 1924. In all this work I have had the untiring assistance of Prof. C. O. Lampland of the Lowell Observatory. The results of our recent investigations are now in press. The present address is based upon the results of these measurements, and many of the illustrations are duplicates of those given in our complete paper on planetary temperatures.

II. The Measurement of Planetary Radiation and Planetary Temperatures.

By planetary radiation is meant the emission of thermal radiation from a planet as a result of warming of its surface by exposure to solar radiation, including heat radiated by virtue of a possible high internal temperature of the planet itself.

The measurement of planetary radiation is essentially a measurement of the heat interchange between the planet and the radiometer receiver, which in this case is a thermocouple of two symmetrically constructed receivers described in a previous paper.[3]

The incoming radiation from the planet is composed of reflected solar radiation, which terminates practically at 8μ ($\mu = 0.001$ mm), and planetary radiation which consists principally of wave lengths 8 to

[2] In this early work I was ably assisted by Dr. S. B. Nicholson who (in collaboration with Edison Pettit) since then has applied this type of thermocouple with remarkable success in similar work, especially on long-period variable stars of low luminosity.

[3] *Popular Astronomy*, **31**, p. 105, 1923.

15μ. The intensity of the planetary radiation varies, of course, with the temperature of the planet.

The outgoing radiation from the thermocouple receivers (which for this work were about 0.2 mm in diameter) is similar to the nocturnal radiation from black objects, which, on clear nights, may be 0.1 gr. cal. per cm^2 per min. When it is provided with a fluorite window, there is heat interchange between the radiometer receiver and the window, for wave lengths greater than about 13μ. When the window is of rock salt, radiation of all wave lengths to 25μ can escape from the radiometer window into the air. For a thermocouple receiver at 14° C (the temperature of the observatory during our observations) about 20 percent of the radiation of wave lengths 8 to 15μ escapes through the earth's atmosphere into interstellar space, and theoretically at least is focused upon the planet under investigation as illustrated diagramatically in Fig. 1.

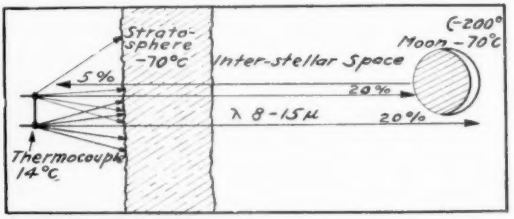


FIG. 1. Schematic drawing showing the escape of low-temperature thermal radiation of certain wave lengths from the thermocouple through the earth's atmosphere to interstellar space and the possible exchange of such radiation between the thermocouple and the planets.

In ordinary laboratory thermometry the two junctions of the thermocouple are placed in some constant temperature bath, say melting ice, to determine the zero reading of the galvanometer. Then, leaving one thermojunction in the ice bath, the other is placed in the material of which the temperature is to be determined. The resulting galvanometer deflection will be negative, positive, or zero depending whether the temperature of the object is lower, higher or the same as that of the ice bath.

It is of course impossible to place one thermojunction in the isothermal layer of the earth's atmosphere, which is at about —70° C, and thrust the other junction out upon the surface of the planet; and thus determine its temperature from the indications of the galvanometer. However, it is practicable to expose the receivers which constitute the two junctions of the vacuum thermocouple to the sky (see Fig. 1) and obtain a zero reading of the galvanometer. Then one receiver is exposed to the image of the planet, and from the intensity of the radiation exchanges (instead of thermal conduction) and an application of

the laws of radiation we can form an estimate of the temperature of the planet.

The atmosphere acts like an opaque screen, at about —70° C, to radiation of all wave lengths except those of 8 to 15μ for which the air is not completely opaque. Part of the radiation of wave lengths 8 to 15μ escapes to interstellar space, which is assumed to be at a temperature of —273° C. However, for our purposes it is sufficient to assume an upper limit of —70° C, which is the temperature of the isothermal layer of the earth's atmosphere. The intensity of the incoming radiation from a planet at —70° C is only about 5 percent of that escaping from the thermocouple into space. But this is not the only thing to be considered. For, when using a rock salt window there is a constant fluctuation of the zero reading of the galvanometer which seems to be caused by variations in transparency of the air for the outgoing radiation from the thermocouple receiver to interstellar space. That this is so is easily shown by inserting the screen of fluorite or of thin glass. The intensity of the incoming radiation from a celestial object at —70° C or lower is very small, and atmospheric conditions, even in the high, dry climate of the Lowell Observatory, must be steady in order to attain an accuracy of 5 percent. A lower altitude and a greater humidity would no doubt suppress this effect. Hence it appears that unless the temperature of the celestial object is up to about —75° C, its presence cannot be determined with certainty from the water-cell transmission, by exposing the thermocouple to the sky and to the object, which is the method usually employed in making the observations.

As illustrated in Fig. 1, if the temperature of the planet is at —70° C, about 5 percent of its total radiation is transmitted (through unit air mass) to the thermocouple, while if its temperature is —120° C only about 1 percent is transmitted. All these energy values are so low that unless the temperature is of the order of —70° C (or higher) the intensity of the incoming radiation is so small that it is difficult to detect. Hence in setting the thermocouple receiver from the sky to the image of the planet if the temperature of the latter is not up to about —70° C the galvanometer gives no definite deflection. For example in setting the thermocouple receiver from the sky upon the image of the dark part of the moon, no galvanometer deflection was observed. From this it would appear that the temperature of the dark part of the moon was lower than —70° C, but whether it was down to —200° C, as some have calculated, cannot be determined.

One difficulty in measuring planetary radiation is that usually the observations must be made when the planet is irradiated by the sun. In this case the planetary radiation can be separated from the solar radiation by inserting into the optical path a cell of water 1 cm in thickness. Such a cell transmits about 75 percent of the direct solar radiation.

Suppose that the dark moon could be suddenly exposed to solar radiation, then, assuming that there is no marked selective reflection

or absorption, the transmission of the radiation from the moon through the water-cell would be 75 percent, as observed for the direct solar radiation.

After a short exposure to solar radiation the temperature of the lunar surface would be somewhat higher than —70° C. On setting the thermocouple receiver from the sky upon the image of the moon (or other planet), part of the outgoing radiation (of wave lengths 8 to 15μ) emanating from the receiver would be balanced by the incoming radiation of wave lengths 8 to 15μ from the planet, causing a positive indication of the galvanometer needle, which is superposed upon the deflection caused by the reflected solar radiation. When the water-cell is interposed this exchange of low temperature radiation is prevented. However, the deflection caused by the solar radiation, in passing through the water-cell, is the same as when the temperature of the planetary surface was at —70° C. Consequently the percent transmission, which is the ratio of the galvanometer deflection observed through the water-cell to the deflection observed without the water-cell, is smaller than 75, which was observed on the planet at —70° C. The warmer the planet the smaller is the percentage transmission through the water-cell, decreasing from 67 percent for Jupiter to less than 30 percent for the darkest regions on Mars.

1. *Planetary Temperatures Derived from the Law of Total Radiation.* Using these water-cell transmissions it is possible to calculate the temperature of the planet by a method suggested by Russell and worked out by Menzel.[4] By this method the temperatures are derived from the fourth-power law of total radiation. All the factors, such as the percent transmission through the water-cell, the transmission factors of the atmosphere, etc., enter as the fourth root in the equation, and hence the errors of observation are minimized in the calculated temperatures. An uncertain factor is the albedo of the isolated areas used in the calculations.

2. *Planetary Temperatures Derived from the Law of Spectral Radiation.*

The data obtained with the water-cell give us no information concerning the spectral energy distribution of the planetary radiation at 8 to 15μ. Hence in addition to the water-cell used in previous measurements of planetary radiation, in the measurements of 1924 a new method was employed. This consisted in separating the planetary radiation of wave lengths 8 to 15μ into two components by means of transmission screens of glass and of fluorite, giving spectral radiation components (A and B) of wave lengths 8 to 12.5μ and 12.5 to 15μ. This involves the laws of spectral radiation, and the errors in the transmission coefficients of the air and of the fluorite screen have a direct effect upon the calculated temperatures. Moreover the ratios of

[4] Menzel. *Astrophys. Journal*, **58**, p. 65, 1923.

the spectral components, A : B, vary but slowly with the temperature, which reduces the accuracy of the temperature estimates.

However, this method is important in testing selective emission. For example, it shows that of the total planetary radiation of wave lengths 8 to 15μ emitted by Venus over 62 percent lies in the region of 8 to 12.5μ, and, hence, that this method, as well as the method of calculation of the temperature of the planet by the fourth-power law, is questionable.

The temperatures derived from the spectral energy distribution of a black body are minimum values. The spectral radiation of the planetary surface would no doubt be selective and its temperature would have to be higher than that of the complete radiator assumed in these calculations. One of the difficulties involved in these calculations is the lack of exact information on the transmission of the atmosphere in the spectral region extending from 8 to 15μ. The data used in these calculations (including the absorption by ozone and CO_2) are due to Fowle.[5]

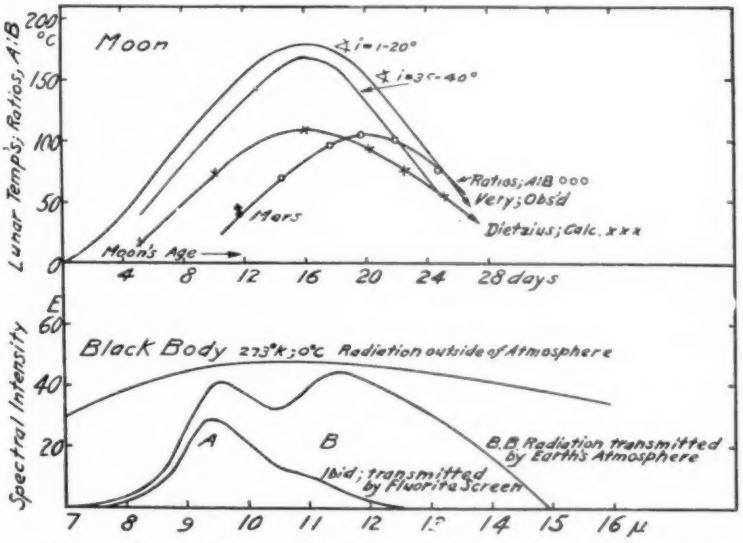


FIG. 2. Showing the methods of obtaining the temperature of Mars by comparison of its spectral components of planetary radiation with that of the moon, and also by calculation using the spectral energy distribution of a black body.

The procedure followed in these calculations consisted in plotting (see lower part of Fig. 2) the spectral energy curve of a black body at, say, 0° C and multiplying the ordinates by the spectral transmission of the air. This gives a new curve extending from 8 to 15μ, with an

[5] Fowle, *Smithsonian Physical Tables*, 7th Ed.

indentation at 10.5μ. The ordinates of this curve, which is supposed to be similar to the incoming planetary radiation, were then multiplied by the transmission factors of the fluorite screen, and the resultant curves were integrated. The areas under these two curves represent the planetary radiation components extending from 8 - 12.5μ and 12.5 - 15μ respectively. The calculated ratios of these two areas, A : B, vary from 36 at —23° C to 59 at 127° C. In practice the planetary temperatures are obtained by comparing the observed ratios with the calculated values.

(To be continued.)

TO MATHEMATICS.

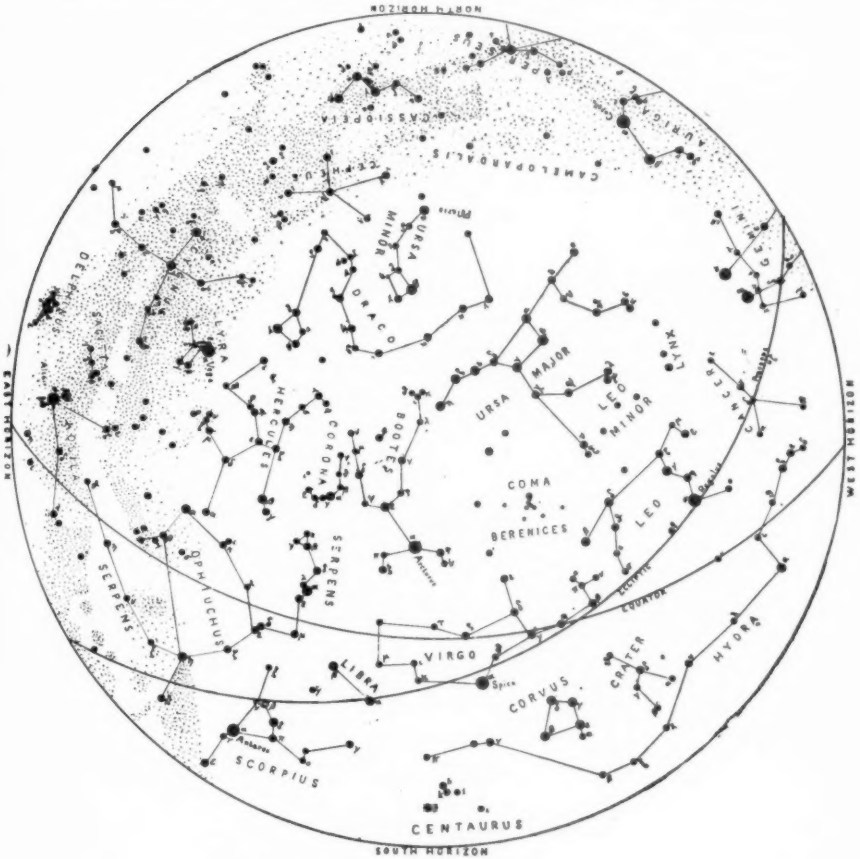
Hail!
Thou god of Mathematics, thou
The child of mighty Reason's brain
And sprung therefrom, as Pallas did
From out the aching head of Jove.
Among thy ancient votaries
Were Thales and Pythagoras,
With Plato and Hippocrates.
And Euclid built to thee a shrine:
His book of "Elements" 'twas called.
Now, modern man, by aid of thee,
Has conquered earth and sea and air—
Has pierced the icy depths of Space
To weigh far-distant, circling worlds
And can foretell the sun's eclipse
Or guide great ships across the sea.
Oh Mathematics, in the years
We call the future, wilt thou guide,
Our still half-childish minds in search
Of the elusive Absolute.

STERLING BUNCH.

Ft. Worth, Texas, Oct. 31, 1924.

PLANET NOTES FOR JUNE.

The *Sun* will move northward until June 21, when it will be 23° 27′ north of the equator. After this date it will move southward slowly and at the end of the month it will be 23° 14′ north. Its motion eastward will be from $4^h\ 33^m$ to $6^h\ 33^m$. It will move from Taurus into Gemini in a path just north of Orion.



THE CONSTELLATIONS AT 9:00 P. M. JUNE 1.

The phases of the *Moon* for the month will occur as follows:

Full Moon	June 6 at	4 P.M.	C.S.T.
Last Quarter	13 "	1 P.M.	"
New Moon	20 "	12 P.M.	"
First Quarter	29 "	10 A.M.	"

The moon will be nearest the earth for the month on June 8 and farthest from the earth on June 23.

Mercury will be on the opposite side of the sun from the earth on June 20. It will be too near the sun throughout the month to be observed. It will move eastward rather rapidly through Taurus into Gemini, passing just north of the Pleiades.

Venus will move eastward a little more rapidly than the sun. At the end of the month it will be visible near the western horizon just after sunset. Mercury and Venus will be rather near to each other in the sky at the end of the month.

Mars, like Mercury and Venus, will be near the sun during this month. On June 1 it will cross the meridian about $2^h\,25^m$ after the sun; on June 15, $2^h\,7^m$ and on June 30, $1^h\,48^m$. It will therefore be too near the sun to be observed.

Jupiter will be approaching a position of opposition, and at the end of the month it will rise soon after sunset. It will be 22° south of the equator in the constellation Sagittarius.

Saturn will be very well situated for observation this month. It will cross the meridian on the average at nine o'clock in the evening. It will be in the constellation Libra.

Uranus will be in quadrature, six hours west of the sun, on June 17. At this date it will therefore cross the meridian at six o'clock in the morning.

Neptune will be on the meridian between three and four o'clock in the afternoon. It will therefore be visible in the western sky during this month.

Occultations Visible at Washington.

[From the *American Ephemeris.*]

Date 1925		Star's Name	Magnitude	IMMERSION. Washington C.T.	IMMERSION. Angle from N	EMERSION. Washington C.T.	EMERSION. Angle from N	Duration
				h m	°	h m	°	h m
June	3	80 Virginis	5.6	1 29	88	2 24	313	0 56
	8	253 B. Sagittarii	6.1	22 23	110	23 27	255	1 4
	13	351 B. Aquarii	6.5	4 14	71	5 35	233	1 20

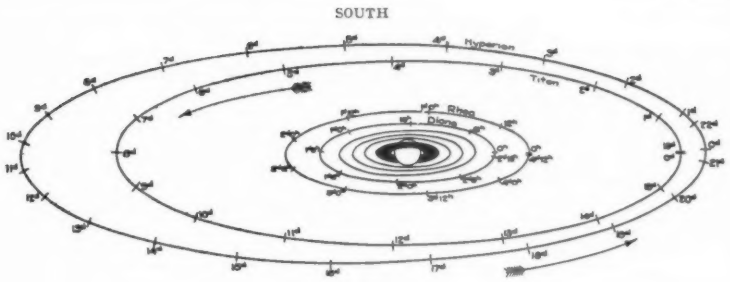
Saturn's Satellites.

[From the *American Ephemeris.*]

CENTRAL STANDARD TIME, MIDNIGHT = 0^h

I. Mimas. Period $0^d\,22^h6$.

1925	d	h		d	h		d	h		d	h	
June	1	3.1	W	June 9	3.3	E	June 17	3.6	W	June 26	2.5	E
	2	1.7	W	10	2.0	E	18	2.2	W	27	1.1	E
	3	0.3	W	11	0.6	E	19	0.8	W	27	23.7	E
	3	22.9	W	11	23.2	E	19	23.4	W	28	22.3	E
	4	21.5	W	12	21.8	E	20	22.0	W	29	20 9	E
	5	20.1	W	13	20.4	E	21	20.6	W	30	19.6	E
	6	18.8	W	14	19.1	E	22	19.3	W			



Apparent orbits of the seven inner satellites of Saturn at date of opposition, May 1, 1925, as seen in an inverting telescope.

II. Enceladus. Period $1^d\ 8^h9$.

1925	d	h		d	h		d	h		d	h
June	1	23.4 E	June	10	4.6 E	June	18	9.9 E	June	26	15.2 E
	3	8.3 E		11	13.5 E		19	18.8 E		28	0.1 E
	4	17.1 E		12	22.4 E		21	3.7 E		29	9.0 E
	6	2.0 E		14	7.3 E		22	12.6 E		30	17.9 E
	7	10.9 E		15	16.1 E		23	21.5 E			
	8	19.8 E		17	1.0 E		25	6.4 E			

III. Tethys. Period $1^d\ 21^h3$.

June	2	6.3 E	June	9	19.5 E	June	17	8.7 E	June	24	21.9 E
	4	3.6 E		11	16.8 E		19	6.0 E		26	19.3 E
	6	0.9 E		13	14.1 E		21	3.3 E		28	16.6 E
	7	22.2 E		15	11.4 E		23	0.6 E		30	13.9 E

IV. Dione. Period $2^d\ 17^h7$.

June	2	18.9 E	June	10	23.9 E	June	19	4.9 E	June	27	9.9 E
	5	12.6 E		13	17.6 E		21	22.6 E		30	3.6 E
	8	6.2 E		16	11.2 E		24	16.3 E			

V. Rhea. Period $4^d\ 12^h5$.

June	4	8.1 E	June	13	8.8 E	June	22	9.5 E	June	26	21.9 E
	8	20.4 E		17	21.1 E						

VI. Titan. Period $15^d\ 23^h3$.

June	8	1.4 W	June	15	23.1 E	June	23	23.3 W			

VII. Hyperion. Period $21^d\ 7^h6$.

June	3	4.5 E	June	13	15.4 W	June	24	9.5 E			

VIII. Japetus. Period $79^d\ 22^h1$.

May	24	5.4 I	June	12	16.4 W	July	3	10.0 S			

NOTE—E, Eastern Elongation; W, Western Elongation; S, Superior Conjunction; I, Inferior Conjunction.

VARIABLE STARS.

Minima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of minima in 1925 June							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
SY Androm.	0 08.0	+43 09	9.5—13.0	34 21.8					22 20			
RT Sculptor.	31.5	—26 13	9.6—10.5	0 12.3	1 10	9 2	16 19	24 11				
U Cephei	0 52.4	+81 20	7.0— 9.0	1 11.8	1 0	9 11	16 23	24 10				
Z Persei	2 33.7	+41 46	9.4—12	3 01.4	3 8	9 11	21 16	27 19				
TW Cassiop.	37.6	+65 19	8.2— 9.0	1 10.3	8 13	17 4	25 16					
RY Persei	39.0	+47 43	8.0—10.3	6 20.7	1 3	7 23	21 17	28 14				
RZ Cassiop.	39.9	+69 13	6.9— 8.1	1 04.7	5 12	12 16	19 21	27 0				
TX Cassiop.	44.4	+62 22	9.4—10.1	2 22.2	4 1	13 20	22 15					
ST Persei	53.7	+38 47	8.5—10.5	2 15.6	1 23	9 21	17 20	25 18				
RX Cassiop.	2 58.8	+67 11	8.6— 9.1	32 07.6							28 4	
Algol	3 01.7	+40 34	2.3— 3.5	2 20.8	1 10	10 0	18 14	27 5				
RT Persei	16.7	+46 12	9.5—11.5	0 20.4	2 3	8 22	22 13	29 8				
λ Tauri	55.1	+12 12	3.3— 4.2	3 22.9	4 1	11 23	19 20	27 18				
RW Tauri	3 57.8	+27 51	7.1— [11	2 18.5	1 22	10 5	18 13	26 21				
RV Persei	4 04.2	+33 59	9.5—11.0	1 23.4	3 19	11 17	19 14	27 11				
RW Persei	13.3	+42 04	8.8—11.0	13 04.8	6 6		19 11					
SZ Tauri	31.4	+18 20	7.2— 7.7	3 03.6	4 18	11 1	23 15	29 22				
RS Cephei	4 48.6	+80 06	9.5—12.0	12 10.1	5 13	17 23	30 9					
TT Aurigae	5 02.8	+39 27	7.8— 8.7	0 16.0	4 15	11 7	17 23	24 15				
RY Aurigae	11.5	+38 13	10.7—11.7	2 17.5	4 3	12 7	20 11	28 15				
RZ Aurigae	42.9	+31 40	10.6—13.3	3 00.3	3 22	9 23	22 0	28 0				
SV Tauri	45.8	+28 05	9.4—11.0	2 04.0	7 2	15 18	24 10					
Z Orionis	50.2	+13 40	9.7—10.7	5 04.9	4 12	14 21	25 7					
SV Gemin.	54.6	+24 28	9.8— [11	4 00.2	1 11	9 11	17 12	25 12				
RW Gemin.	5 55.4	+23 08	9.5—11.0	2 20.8	1 13	13 0	18 17	30 5				
U Columbæ	6 11.2	—33 03	9.2—10.0	2 19.2	1 12	12 17	18 7	29 12				
SX Gemin.	22.0	+20 37	10.8—11.5	1 08.8	8 19	17 0	25 5					
RW Monoc.	29.3	+ 8 54	9.0—10.8	1 21.7	4 18	12 9	20 0	27 15				
RX Gemin.	43.6	+33 21	8.8— 9.6	12 05.0	4 19	17 0	29 5					
RU Monoc.	6 49.4	— 7 28	9.8—10.5	0 21.5	2 20	10 0	17 4	24 8				
R Can. Maj.	7 14.9	—16 12	5.8— 6.4	1 03.3	3 7	10 3	23 18	30 14				
RY Gemin.	21.7	+15 52	8.9— [10	9 07.2	10 6	19 13	28 21					
Y Camelop.	27.6	+76 17	9.5—12	3 07.3	4 9	11 0	24 5	30 20				
TX Gemin.	30.3	+17 08	10.0—11.9	2 19.2	7 10	15 19	24 5					
RR Puppis	43.5	—41 08	9.4—10.7	6 10.3	5 1	11 11	24 8	30 18				
V Puppis	7 55.4	—48 58	4.1— 4.8	1 10.9	6 12	13 19	21 2	28 8				
X Carinae	8 29.1	—58 53	7.9— 8.7	0 13.0	8 15	16 17	24 20					
S Cancri	8 38.2	+19 24	8.2—10	9 11.6	2 17	12 5	21 17					
RX Hydrae	9 00.8	— 7 52	9.1—10.5	2 06.8	1 12	8 9	22 1	28 21				
S Velorum	29.4	—44 46	7.8— 9.3	5 22.4	5 16	11 15	23 12	29 10				
Y Leonis	9 31.1	+26 41	9.3—11.2	1 16.5	4 23	11 17	18 11	25 4				
RR Velorum	10 17.8	—41 36	10.0—10.9	1 20.5	2 5	9 15	17 1	24 11				
SS Carinæ	10 54.2	—61 23	12.2—12.8	3 07.2	5 13	12 3	18 18	25 8				
ST Urs. Maj.	11 22.4	+45 44	6.7— 7.2	8 19.2	8 7	17 2	25 21					
RW Urs. Maj.	35.4	+52 34	10.3—11.4	7 07.9	6 7	13 15	20 23	28 7				
Z Draconis	11 39.8	+72 49	9.9—13.6	1 08.6	5 11	12 6	19 1	25 20				
RZ Centauri	12 55.6	—64 05	8.5— 8.9	1 21.0	4 10	11 22	19 10	26 22				
RS Can. Ven.	13 06.3	+36 28	7.5—12.5	4 19.1	7 3	16 18	26 8					
SS Centauri	07.2	—63 37	8.8—10.4	2 11.5	3 11	10 22	18 8	25 19				
SX Hydræ	13 39.0	—26 23	8.6—12.7	2 21.5	4 11	10 6	21 20	27 15				

Minima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of minima in 1925 June							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
δ Libræ	14 55.6	— 8 07	4.8— 6.2	2 07.9	3 2	10 1	17 1	24 0				
U Coronæ	15 14.1	+32 01	7.6— 8.7	3 10.9	6 20	13 17	20 15	27 13				
TW Draconis	15 32.4	+64 14	7.3— 8.9	2 19.4	4 16	13 2	21 12	29 22				
SS Libræ	15 43.4	—15 14	9.3—11.5	0 18.4	4 21	12 2	19 6	26 11				
SW Ophiuchi	16 11.1	— 6 44	9.2—10.0	2 10.7	3 17	11 1	18 9	25 18				
SX Ophiuchi	12.6	— 6 25	10.5—11.2	2 01.5	2 23	11 6	19 12	27 18				
R Aræ	31.1	—56 48	6.8— 7.9	4 10.2	7 16	16 12	25 9					
TT Herculis	16 49.9	+17 00	8.9— 9.3	20 18.1		15 21						
TU Herculis	17 09.8	+30 50	9.5—12	2 06.4	2 19	9 14	23 5	30 0				
U Ophiuchi	11.5	+ 1 19	6.0— 6.7	0 20.1	8 13	16 23	25 8					
ω Herculis	13.6	+33 12	4.6— 5.4	2 01.2	6 5	12 9	24 16	30 20				
TX Herculis	15.4	+42 00	8.3— 9.0	1 00.7	2 19	9 0	21 8	27 12				
RV Ophiuchi	29.8	+ 7 19	9. —12	3 16.5	5 15	13 0	20 9	27 18				
SZ Herculis	36.0	+33 01	9.5—10.3	0 19.6	3 6	11 10	19 14	27 18				
TX Scorpii	48.6	—34 13	7.5— 8.2	0 22.6	5 20	13 9	20 22	28 11				
UX Herculis	49.7	+16 57	8.8—10.5	1 13.2	3 3	10 20	18 14	26 8				
Z Herculis	53.6	+15 09	7.1— 7.9	3 23.8	8 14	16 13	24 13					
WX Sagittarii	53.6	—17 24	9.2—10.8	2 03.1	6 8	14 20	23 9					
WY Sagittarii	17 54.9	—23 01	9.5—10.6	4 16.0	4 20	14 4	18 20	28 5				
SX Draconis	18 03.0	+58 23	9.3—10.5	5 04.1	6 2	11 6	21 14	26 18				
RS Sagittarii	11.0	—34 08	5.9— 6.3	2 10.0	2 17	9 23	17 5	24 11				
V Serpentis	11.1	—15 34	9.5—11.1	3 10.9	5 11	12 9	19 7	26 5				
RZ Scuti	21.1	— 9 15	7.4— 8.3	15 03.2		13 16		29 20				
RZ Draconis	21.8	+58 50	9.5—10.2	0 13.2	6 13	13 17	20 21	28 1				
RX Herculis	26.0	+12 32	7.0— 7.6	0 21.3	2 17	9 20	16 23	24 1				
SX Sagittarii	39.7	—30 36	8.7— 9.8	2 01.8	7 7	15 14	23 22					
RR Draconis	40.8	+62 34	9.3—13	2 19.9	3 23	12 10	20 22	29 10				
RS Scuti	43.7	—10 21	9.3—10.3	0 15.9	5 9	12 1	18 15	25 7				
β Lyræ	46.4	+33 15	3.4— 4.1	12 21.8	1 21	14 18	27 16					
U Scuti	18 48.9	—12 44	9.1— 9.6	0 22.9	7 23	15 14	23 5	30 21				
RX Draconis	19 01.1	+58 35	9.3—10.2	1 21.4	5 0	12 13	20 3	27 17				
RV Lyræ	12.5	+32 15	11. —12.8	3 14.4	1 15	8 20	23 5	30 10				
RS Vulpec.	13.4	+22 16	6.9— 8.0	4 11.4	3 16	12 15	21 14	30 13				
U Sagittæ	14.4	+19 26	6.5— 9.0	3 09.1	5 22	12 17	19 11	26 5				
Z Vulpec.	17.5	+25 23	7.3— 8.5	2 10.9	5 17	13 2	20 10	27 19				
TT Lyræ	24.3	+41 30	9.4—11.6	5 05.8	4 2	14 14	19 20	30 7				
UZ Draconis	26.1	+68 44	9.0— 9.8	1 15.1	1 15	8 4	21 5	27 18				
SY Cygni	19 42.7	+32 28	10. —12	6 00.2	6 2	12 2	24 3	30 3				
WW Cygni	20 00.6	+41 18	9.3—13.4	3 07.6	2 0	8 15	21 21	28 13				
SW Cygni	03.8	+46 01	9. —11.7	4 13.8	1 15	10 18	19 22	29 1				
VW Cygni	11.4	+34 12	9.8—11.8	8 10.3	5 9	13 19	22 5	30 16				
RW Capric.	12.2	—17 59	8.8—10.6	3 09.4	2 19	9 14	23 4	29 23				
UW Cygni	19.6	+42 55	10.5—13	3 10.8	5 16	12 14	19 12	26 9				
V Vulpec	32.3	+26 15	8.2— 9.8	37 19.0	8 0							
W Delphini	33.1	+17 56	9.4—12.1	4 19.4	4 15	14 6	23 21					
RR Delphini	38.9	+13 35	10.5—11.8	4 14.4	3 21	13 2	22 7					
Y Cygni	48.1	+34 17	7.1— 7.9	1 12.0	1 16	10 16	19 16	28 15				
WZ Cygni	49.3	+38 27	9.9—10.8	0 14.0	6 22	14 13	22 3	29 17				
RR Vulpec	20 50.5	+27 32	9.6—11.0	5 01.2	1 23	12 2	22 4					
RY Aquarii	21 14.8	—11 14	8.8—10.4	1 23.2	2 14	10 11	18 8	26 5				
UZ Cygni	35.2	+43 52	8.9—11.6	31 07.3		19 8						
RT Lacertæ	21 57.4	+43 24	9.1—10.5	5 01.7	2 19	12 23	23 2					
RW Lacertæ	22 40.6	+49 08	10.2—11.2	5 04.4	2 6	12 14	17 19	28 4				
VW Pegasi	51.7	+32 42	10.0—10.6	5 06.4	4 2	14 15	19 22	30 11				
Y Piscium	23 29.3	+ 7 22	9.0—12.0	3 18.4	7 17	15 5	22 18	30 7				
TW Androm.	23 58.2	+32 17	8.6—11.5	4 02.9	4 19	13 1	21 7	29 13				

Maxima of Variable Stars of Short Period.

[Calculated by members of the classes in Astronomy at Carleton College.]

Given to the nearest hour in Greenwich civil time; to obtain Eastern Standard time subtract 5^h; Central Standard time 6^h, etc.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1925 June					
	h m	° ′		d h	d h	d h	d h	d h	d h	d h
SX Cassiop.	0 05.5	+54 20	8.6— 9.2	36 13.7	10 6					
SY Cassiop.	0 09.8	+57 52	9.3— 9.9	4 01.7	1 13	9 17	17 20	26 0		
RR Ceti	1 27.0	+ 0 50	8.3— 9.0	0 13.3	4 9	12 3	19 20	27 14		
RW Cassiop.	1 30.7	+57 15	8.9—11.0	14 19.2		13 0		27 20		
V Arietis	2 09.6	+11 46	8.3— 9.0	0 23.8	5 20	13 19	21 17	29 16		
SU Cassiop.	2 43.0	+68 28	6.5— 7.0	1 22.8	3 19	11 14	19 10	27 5		
RW Camelop.	3 46.2	+58 21	8.2— 9.4	16 00.0	1 21		18 7			
SX Persei	4 10.2	+41 27	10.4—11.2	4 07.0	4 20	13 9	21 23	30 13		
SV Persei	42.8	+42 07	8.8— 9.6	11 03.1	6 3	17 6	28 9			
RX Aurigæ	4 54.5	+39 49	7.2— 8.1	11 15.0	1 14	13 5	24 20			
SX Aurigæ	5 04.6	+42 02	8.0— 8.7	1 12.8	1 1	8 17	16 9	24 1		
SY Aurigæ	05.5	+42 41	8.4— 9.5	10 03.3	9 14	19 17	29 21			
Y Aurigæ	21.5	+42 21	8.6— 9.6	3 20.6	3 11	11 4	18 21	26 15		
RZ Gemin.	5 56.6	+22 15	9.1—10.0	5 12.7	5 17	11 6	22 7	27 20		
RS Orionis	6 16.5	+14 44	8.2— 8.9	7 13.6	3 16	11 5	18 19	26 8		
T Monoc.	19.8	+ 7 08	5.7— 6.8	27 00.3				26 4		
R Aurigæ	23.0	+30 33	5.1— 6.0	3 17.5	7 11	14 22	22 9	29 20		
W Gemin.	29.2	+15 24	6.7— 7.5	7 22.0	7 17	15 15	23 13			
ζ Gemin.	6 58.2	+20 43	3.7— 4.3	10 03.7	3 22	14 1	24 5			
RU Camelop	7 10.9	+69 51	8.5— 9.8	22 06.5		21 18				
RR Gemin.	7 15.2	+31 04	10.0—11.5	0 09.5	6 17	14 15	22 14			
V Carinae	8 26.7	—59 47	7.4— 8.1	6 16.7	4 17	11 9	18 2	24 19		
T Velorum	8 34.4	—47 01	7.6— 8.5	4 15.3	4 8	13 14	18 6	27 12		
V Velorum	9 19.2	—55 32	7.5— 8.2	4 08.9	3 22	12 16	21 10	30 4		
Z Leonis	9 46.4	+27 22	7.9— 9.6	56 08.7		14 11				
RR Leonis	10 02.1	+24 29	9.1—10.1	0 10.9	2 5	9 1	22 14	29 9		
SU Draconis	11 32.2	+67 53	8.9— 9.6	0 15.8	3 10	10 1	23 5	29 20		
S Muscae	12 07.4	—69 36	6.4— 7.3	9 15.8	7 23	17 15	27 7			
SW Draconis	12.8	+70 04	8.8— 9.6	0 13.7	5 18	13 18	21 17	29 16		
T Crucis	15.9	—61 44	6.8— 7.6	6 17.6	3 19	10 13	24 0	30 17		
R Crucis	18.1	—61 04	6.8— 7.9	5 19.8	4 19	10 15	22 7	28 2		
S Crucis	12 48.4	—57 53	6.5— 7.6	4 16.6	2 1	11 10	20 19	30 4		
W Virginis	13 20.9	— 2 52	8.7—10.4	17 06.5		12 22		30 4		
SS Hydræ	25.0	—23 08	7.4— 8.1	8 04.8	6 7	14 12	22 17	30 22		
RV Urs. Maj.	13 29.4	+54 31	9.2— 9.9	0 11.2	5 2	12 3	19 3	26 4		
ST Virginis	14 22.5	— 0 27	10.3—11.4	0 09.9	6 10	13 19	21 5	28 15		
V Centauri	25.4	—56 27	6.4— 7.8	5 11.9	3 7	14 7	19 18	30 18		
RS Bootis	29.3	+32 11	8.9—10.0	0 09.1	2 9	9 22	17 12	25 1		
R Triang.Austr.	15 10.8	—66 08	6.7— 7.4	3 09.3	6 19	13 14	20 9	27 3		
S Triang.Austr.	15 52.2	—63 29	6.4— 7.4	6 07.8	4 5	10 13	23 5	29 12		
S Normæ	16 10.6	—57 39	6.6— 7.6	9 18.1	2 14	12 8	22 2			
RW Draconis	33.7	+58 03	9.6—10.8	0 10.6	6 18	15 15	24 11			
RV Scorpii	16 51.8	—33 27	6.7— 7.4	6 01.5	5 18	11 20	23 23	30 0		
X Sagittarii	17 41.3	—27 48	4.4— 5.0	7 00.3	2 2	9 3	23 3	30 3		
Y Ophiuchi	47.3	— 6 07	6.1— 6.5	17 02.9	6 20		23 23			
W Sagittarii	17 58.6	—29 35	4.3— 5.1	7 14.3	2 17	10 7	17 21	25 11		
Y Sagittarii	18 15.5	—18 54	5.4— 6.2	5 18.6	6 9	12 4	17 22	23 17		
U Sagittarii	26.0	—19 12	6.5— 7.3	6 17.9	2 3	8 21	22 9	29 3		
Y Scuti	32.6	— 8 27	8.7— 9.2	10 08.3	3 15	14 0	24 8			
RZ Lyræ	39.9	+32 42	9.9—11.2	0 12.3	7 23	15 15	23 7	30 23		
RT Scuti	18 44.1	—10 30	9.1— 9.7	0 11.9	7 6	14 16	22 3	29 13		
κ Pavonis	18 46.6	—67 22	3.8— 5.2	9 02.2	1 10	10 13	19 14	28 7		
U Aquilæ	19 24.0	— 7 15	6.2— 6.9	7 00.6	7 21	14 22	21 22	28 23		

Maxima of Variable Stars of Short Period—Continued.

Star	R.A. 1900	Decl. 1900	Magnitude	Approx. Period	Greenwich civil times of maxima in 1925 June							
	h m	° ′		d h	d h	d h	d h	d h	d h	d h	d h	d h
XZ Cygni	19 30.4	+56 10	8.6— 9.3	0 11.2	1 6	8 6	22 6	29 6				
U Vulpec.	32.2	+20 07	6.5— 7.6	7 23.5	1 11	9 11	17 10	25 10				
SU Cygni	40.8	+29 01	6.2— 7.0	3 20.3	7 14	15 7	22 23	30 16				
η Aquilæ	47.4	+ 0 45	3.7— 4.5	7 04.2	5 19	12 23	20 3	27 8				
S Sagittæ	51.5	+16 22	5.6— 6.4	8 09.2	3 8	11 17	20 2	28 11				
X Vulpec.	19 53.3	+26 17	9.5—10.5	6 07.7	6 1	12 8	18 16	25 0				
X Cygni	20 39.5	+35 14	6.0— 7.0	16 09.3		13 0		29 19				
T Vulpec.	47.2	+27 52	5.5— 6.1	4 10.5	2 23	11 20	20 16	29 13				
UY Cygni	52.3	+30 03	9.6—10.4	0 13.5	2 19	9 13	23 0	29 17				
RV Capric.	55.9	—15 37	9.2—10.1	0 10.7	1 13	8 6	21 17	28 10				
TX Cygni	20 56.4	+42 12	8.5— 9.7	14 17.4	5 4		19 21					
VY Cygni	21 00.4	+39 34	8.8— 9.5	7 20.6	7 7	15 4	23 0	30 21				
SW Aquarii	10.2	— 0 20	9.9—10.8	0 11.0	3 2	9 23	23 18	30 15				
VZ Cygni	21 47.7	+42 40	8.2— 9.2	4 20.7	2 18	12 11	17 8	27 1				
Y Lacertæ	22 05.2	+50 33	9.1— 9.6	4 07.8	1 8	9 23	18 15	27 7				
δ Cephei	25.5	+57 54	3.7— 4.6	5 08.8	5 19	11 4	21 21	27 6				
Z Lacertæ	36.9	+56 18	8.2— 9.0	10 21.1		11 13	22 11					
RR Lacertæ	37.5	+55 55	8.5— 9.2	6 10.1	5 22	12 8	18 18	25 4				
V Lacertæ	44.5	+55 48	8.5— 9.5	4 23.6	4 18	9 17	19 16	24 16				
X Lacertæ	22 45.0	+55 54	8.2— 8.6	5 10.7	6 1	11 12	22 9	27 20				
SW Cassiop.	23 03.7	+58 11	9.2— 9.7	5 10.6	3 1	13 23	19 9	30 6				
RS Cassiop.	32.6	+61 52	9.0—11.0	6 07.1	1 18	8 1	20 15	26 22				
RY Cassiop.	47.2	+58 11	9.3—11.8	12 03.4	6 18		18 22					
V Cephei	23 51.7	+82 38	6.0— 7.0	0 23.9	1 16	8 16	22 15	29 15				

Monthly Report of the American Association of Variable Star Observers, March, 1925.

Thanks to the efforts of Messrs. W. S. Brotzman and Wm. McAteer of Pittsburgh, Pa., the AAVSO Library is now installed at the Association headquarters at Cambridge. Mr. P. R. Allen, the recently appointed Librarian, extends an earnest invitation to all of our members to make active use of this very valuable collection of books and pamphlets which contains some very rare and authoritative volumes. Please address all communications to the AAVSO Library, care of Harvard Observatory, Cambridge. The 5-inch telescope, so successfully used by the late Mr. C. Y. McAteer, has been loaned to Mr. R. S. Johnstone of Glenshaw, Pa.

Attention is called to the Spring Meeting of the Association which is to be held at Leonia, N. J., on May 23, 1925. Elaborate plans are being made by our President to assure us a very successful and enjoyable affair.

Mr. S. Lynn Rhorer, our member in Atlanta, Ga., has recently closed his third successful season of open nights at Miami, Fla., where he has had three 5-inch telescopes made available to the layman from all parts of the country. Mr. Rhorer has had an able corps of aids assisting him in this truly altruistic work. Dr. Shapley made a special trip to Miami and St. Petersburg in order to further the layman's interest in Astronomy and in the Association. Mr. Rhorer's example might well be followed in many other large centers of pleasure.

VARIABLE STAR OBSERVATIONS RECEIVED DURING MARCH, 1925.

January 0, 1925 = J. D. 2424151. February 0, 1925 = J. D. 2424182.
March 0, 1925 = J. D. 2424210.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
000339 V SCULPTORIS—						
	4176.5	[13.3	Bl			
001032 S SCULPTORIS—						
	4152.5	7.7	Bl	4171.8	8.2	Sm
	4159.5	7.8	Bl	4176.8	8.2	Sm
	4161.8	7.9	Ht	4182.8	8.9	Sm
	4165.8	7.9	Sm	4196.5	8.6	Bl
	4167.5	8.3	Bl			
001046 X ANDROMEDAE—						
	4206.0	[13.1	B			
001620 T CETI—						
	4192.4	5.7	Kd			
001726 T ANDROMEDAE—						
	4152.7	8.4	Ch	4180.5	9.9	Ch
	4162.6	9.0	Ch	4202.0	11.7	Pt
001755 T CASSIOPEIAE—						
	4159.6	7.5	Ch	4210.2	9.5	Sg
	4185.8	8.1	L	4214.0	9.5	Jo
	4201.0	9.5	Jo	4220.2	9.0	Pt
	4208.8	9.4	L			
J01838 R ANDROMEDAE—						
	4199.1	14.7	Wf	4223.0	14.2	Pt
001862 S TUCANAE—						
	4152.5	10.2	Bl	4171.8	11.3	Sm
	4159.5	10.3	Bl	4176.8	11.6	Sm
	4165.8	11.1	Sm	4176.5	12.0	Bl
	4167.5	11.6	Bl			
001909 S CETI—						
	4164.5	[11.5	Ch			
002546 T PHOENICIS—						
	4152.5	11.3	Bl	4171.8	9.8	Sm
	4159.5	10.3	Bl	4176.5	9.7	Bl
	4165.8	10.0	Sm	4176.8	9.8	Sm
	4167.5	9.8	Bl	4181.8	9.8	Sm
002833 W SCULPTORIS—						
	4167.5	13.0	Bl			
003179 Y CEPHEI—						
	4217.2	12.2	Br			
004047 U CASSIOPEIAE—						
	4202.0	12.6	Pt	4209.1	13.0	Lv
004132 RW ANDROMEDAE—						
	4167.7	8.8	Ch	4202.0	10.7	Pt
	4176.7	9.1	Ch			
004435 X SCULPTORIS—						
	4152.5	11.7	Bl	4167.5	11.3	Bl
	4159.5	11.5	Bl	4176.5	10.7	Bl
004746a RV CASSIOPEIAE—						
	4202.0	13.5	Pt			
004746b — CASSIOPEIAE—						
	4202.0	10.9	Pt			
004958 W CASSIOPEIAE—						
	4202.0	10.9	Pt	4215.0	9.6	B
	4203.1	10.3	B	4223.0	9.5	B
005475 U TUCANAE—						
	4152.5	12.3	Bl	4167.5	13.1	Bl
	4165.9	12.7	Sm			
005840 RX ANDROMEDAE—						
	4202.0	[11.3	Pt	4215.0	[12.4	Pt
	4209.1	11.0	Pt	4216.0	[12.4	Pt
	4210.0	11.1	Pt	4217.2	13.3	Br
	4210.2	11.4	Br	4223.0	11 1	Pt
	4213.0	[11.9	Pt			
010630 U SCULPTORIS—						
	4152.5	12.5	Bl	4167.5	13.2	Bl
010940 V ANDROMEDAE—						
	4203.1	12.0	B			
011041 UZ ANDROMEDAE—						
	4205.1	13.4	B			
011272 S CASSIOPEIAE—						
	4201.2	12.0	Sg	4217.2	11.3	Br
	4206.1	11.3	B	4223.0	11.4	Pt
	4206.2	11.8	Sg	4224.1	10.9	Sg
011712 U PISCIUM—						
	4223.0	12.3	Pt			
012350 RZ PERSEI—						
	4213.1	9.2	B	4226.1	9.1	Y
012502 R PISCIUM—						
	4223.0	7.9	Pt			
013238 RU ANDROMEDAE—						
	4223.0	12.4	Pt			
013338 Y ANDROMEDAE—						
	4223.0	13.8	Pt			
014958 X CASSIOPEIAE—						
	4213.6	12.1	B	4223.0	12.3	Pt
	4223.0	12.3	B			
015354 U PERSEI—						
	4210.2	9.8	Sg	4223.0	9.6	Pt
	4212.0	9.8	B	4224.2	9.9	Sg
015912 S ARIETIS—						
	4203.0	14.0	B	4223.0	13.6	Pt
021024 R ARIETIS—						
	4167.7	10.2	Ch	4223.0	12.6	Pt
	4209.1	12.4	Lv			
021143a W ANDROMEDAE—						
	4159.6	7.7	Ch	4213.0	9.5	B
	4174.7	8.9	Ch	4223.0	10.0	B
	4193.4	9.0	Kk	4223.0	9.8	Pt
021258 T PERSEI—						
	4173.7	9.1	Ch	4223.0	8.4	Pt
021281 Z CEPHEI—						
	4217.2	[13.0	Br			
021403 o CETI—						
	4152.6	3.8	Ch	4190.4	4.5	H
	4155.5	3.8	Ch	4191.7	3.9	L
	4159.5	3.9	Ch	4192.4	4.5	H
	4162.6	3.9	Ch	4193.4	4.1	Kk
	4170.7	4.0	Ch	4194.4	4.1	Kk
	4173.6	4.0	Ch	4195.4	4.1	Kk
	4176.6	3.9	Ch	4196.4	4.1	Kk
	4179.5	4.0	Ch	4199.1	4.5	Wf
	4181.6	4.1	Ch	4203.0	4.7	Ly
	4183.4	4.3	H	4205.4	5.0	Kk
	4183.7	4.0	Ch	4205.4	4.6	H
	4184.4	4.0	Kk	4206.0	4.7	Ly

VARIABLE STAR OBSERVATIONS RECEIVED DURING MARCH, 1925—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
021403 o CETI—Continued.						
	4184.4	4.2	H	4206.4	5.0	Kk
	4184.7	4.0	Ch	4206.4	4.6	H
	4184.8	3.8	L	4206.8	5.1	L
	4185.4	4.0	Kk	4207.0	5.4	Al
	4185.5	4.1	Ch	4207.4	5.1	Kk
	4185.5	4.4	H	4211.0	4.9	Ly
	4186.4	4.3	H	4223.0	5.8	Ly
	4186.4	4.1	Kk	4223.0	5.3	Pt
	4189.4	4.5	H			
021558 S PERSEI—						
	4173.7	10.6	Ch	4223.0	11.2	Pt
	4203.1	10.7	B	4223.1	10.9	B
	4215.1	10.7	B			
022000 R CETI—						
	4164.4	[10.2	Ch			
022150 RR PERSEI—						
	4202.1	13.4	B	4226.1	13.5	Y
	4223.0	13.3	Pt			
022426 R FORNACIS—						
	4152.5	9.8	Bl	4167.5	10.5	Bl
	4159.5	9.8	Bl	4176.5	10.8	Bl
022813 U CETI —						
	4164.6	10.6	Ch			
023080 RR CEPHEI—						
	4217.2	[13.6	Br			
023133 R TRIANGULI—						
	4159.7	6.5	Ch	4223.0	9.3	Pt
	4176.6	7.1	Ch	4223.0	9.6	Ya
	4183.7	7.6	Ch	4223.1	9.6	B
	4209.1	8.5	Lv	4226.1	9.8	Lv
	4213.1	9.0	B			
024356 W PERSEI—						
	4213.1	8.8	B	4223.1	8.8	B
	4217.2	8.8	Cy	4223.1	9.0	Cy
	4223.0	8.6	Pt	4230.0	9.2	Cy
025050 R HOROLOGII—						
	4152.5	8.8	Bl	4175.9	10.2	Sm
	4159.5	8.8	Bl	4176.5	10.0	Bl
	4161.8	9.5	Ht	4179.8	10.2	Ht
	4167.5	9.3	Bl	4182.9	10.2	Sm
	4168.8	10.0	Sm			
025751 T HOROLOGII—						
	4152.5	8.3	Bl	4176.5	9.2	Bl
	4159.5	8.9	Bl	4176.9	9.6	Sm
	4167.5	8.3	Bl	4182.9	9.8	Sm
	4168.8	9.2	Sm			
030514 U ARIETIS—						
	4205.1	12.9	B	4226.0	11.5	Y
	4224.1	12.1	B			
031401 X CETI—						
	4185.8	9.4	L	4208.8	9.7	L
	4199.1	9.3	Wf	4215.0	10.6	B
	4203.1	9.6	B	4223.0	11.0	Pt
032043 Y PERSEI—						
	4204.1	8.9	B	4223.0	8.0	Pt
032335 R PERSEI—						
	4199.1	11.0	Wf	4223.0	12.2	Pt
	4206.1	12.1	B	4224.1	12.9	B
	4217.1	12.5	B			
042209 R TAURI—						
	4201.2	10.2	B	4224.1	8.3	B
	4208.1	9.9	B	4223.0	8.4	Pt
	4213.0	9.0	B	4226.0	8.2	Y
	4215.1	8.9	B	4227.1	8.5	Ya
042215 W TAURI—						
	4206.1	12.3	B	4224.1	12.5	B
	4217.1	12.3	B	4226.2	12.2	Cy
	4223.0	11.8	Pt	4226.2	12.2	Hy
	4223.1	12.2	Cy	4226.2	12.3	Em
	4223.1	9.9	Sg			
042309 S TAURI—						
	4172.5	[10.6	Ch	4213.0	[12.5	B
	4201.2	[13.0	B	4224.1	[13.0	B
	4203.1	13.1	Y	4226.0	13.1	Y
	4208.1	[13.1	B			
043065 T CAMELOPARDALIS—						
	4185.2	12.9	L	4223.0	9.8	Pt
	4208.8	10.8	L	4227.1	10.0	Ya
043208 RX TAURI—						
	4200.1	11.0	Lv	4223.0	10.3	Pt
	4205.1	10.4	B	4223.1	10.1	Bi
	4209.1	10.7	Lv	4226.1	10.5	B
	4215.1	10.3	B			
043263 R RETICULI—						
	4152.5	7.5	Bl	4175.9	8.3	Sm
	4159.5	7.3	Bl	4176.5	8.1	Bl
	4161.8	7.3	Ht	4179.8	8.7	Ht
	4167.5	7.5	Bl	4182.9	8.7	Sm
	4168.9	7.8	Sm			
043274 X CAMELOPARDALIS—						
	4205.1	9.4	B	4223.0	8.4	Pt
	4215.1	8.6	B	4227.1	8.3	Ya
043562 R DORADUS—						
	4152.5	5.5	Bl	4175.9	5.8	Sm
	4159.5	5.4	Bl	4176.5	5.4	Bl
	4168.9	5.6	Sm	4182.9	5.8	Sm
	4167.5	5.3	Bl			
043738 R CAELI—						
	4152.6	12.0	Bl	4176.5	11.3	Bl
	4159.5	11.8	Bl	4179.8	11.4	Ht
	4167.5	11.7	Bl			
044349 R PICTORIS—						
	4152.5	9.4	Bl	4167.5	9.4	Bl
	4159.5	9.4	Bl	4176.5	9.4	Bl
044617 V TAURI—						
	4199.1	10.4	Wf	4217.2	8.7	Wf
	4202.1	9.6	B	4223.0	8.8	Pt
	4213.2	8.9	B			
045307 R ORIONIS—						
	4206.1	13.3	B			
045514 R LEPORIS—						
	4146.1	8.2	Ls	4203.1	7.4	Ly
	4155.5	7.0	Ch	4204.1	7.2	B
	4164.6	6.4	Ch	4205.0	7.4	Al
	4180.5	6.5	Bh	4205.4	7.6	Kk
	4183.4	7.4	Kk	4206.4	7.5	Kk
	4184.4	7.4	Kk	4206.8	6.8	L
	4185.4	7.4	Kk	4207.1	7.0	Jo
	4185.8	6.9	L	4207.4	7.5	Kk
	4186.4	7.5	Kk	4210.4	7.6	Kk

VARIABLE STAR OBSERVATIONS RECEIVED DURING MARCH, 1925—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
045514 R LEPORIS—Continued.						
	4192.5	7.5	Kk	4214.0	6.5	Jo
	4193.4	7.5	Kk	4215.1	7.1	B
	4194.4	7.5	Kk	4223.0	7.6	Ly
	4195.4	7.6	Kk	4223.0	6.5	Pt
	4196.4	7.5	Kk	4223.1	7.0	Al
	4201.1	7.0	Jo	4226.0	7.8	Ya
050003 V ORIONIS—						
	4206.1	11.9	B	4223.0	12.5	Pt
	4217.1	12.4	B	4224.1	12.5	B
050022 T LEPORIS—						
	4152.6	8.4	Bl	4205.1	9.0	B
	4159.5	8.2	Bl	4215.1	9.3	B
	4167.5	8.2	Bl	4223.0	10.1	Pt
	4176.5	8.8	Bl			
050848 S PICTORIS—						
	4152.5	10.7	Bl	4176.5	7.4	Bl
	4159.5	9.7	Bl	4176.9	7.6	Sm
	4167.5	8.2	Bl	4178.8	7.4	Bl
	4169.9	8.1	Sm	4182.9	7.4	Sm
050953 R AURIGAE—						
	4212.1	9.6	B	4223.0	9.7	Pt
	4217.1	9.5	B			
051247 T PICTORIS—						
	4167.5	11.9	Bl	4176.9	11.8	Sm
	4169.9	12.1	Sm	4182.9	10.9	Sm
	4176.5	11.2	Bl			
051533 T COLUMBAE—						
	4152.6	8.3	Bl	4171.8	9.3	Sm
	4159.5	8.7	Bl	4176.5	9.1	Bl
	4161.9	9.2	Ht	4176.9	10.0	Sm
	4165.8	9.0	Sm	4179.9	9.2	Ht
	4167.5	8.8	Bl	4182.9	10.3	Sm
052034 S AURIGAE—						
	4201.2	8.9	B	4217.1	9.0	B
	4212.1	8.9	B	4223.0	9.0	Ya
	4210.0	8.4	Pt	4224.2	8.9	Sg
	4210.2	9.3	Sg			
052036 W AURIGAE—						
	4202.1	12.4	B	4223.0	10.2	Pt
	4212.1	11.2	B	4226.1	9.7	B
	4217.1	10.4	B			
052404 S ORIONIS—						
	4204.2	9.1	B	4215.1	9.3	B
	4210.0	9.1	Pt	4223.0	9.4	Pt
053005a T ORIONIS—						
	4184.8	10.2	L	4212.2	11.1	B
	4191.8	11.1	L	4213.0	10.3	Pt
	4192.4	10.2	Kk	4215.0	10.4	Pt
	4193.8	11.0	L	4216.0	10.4	Pt
	4195.4	10.7	Kk	4217.0	10.4	Pt
	4202.2	11.0	B	4217.1	10.3	B
	4202.0	10.6	Pt	4222.0	10.1	Pt
	4206.8	11.5	L	4223.0	10.5	Pt
	4208.8	11.0	L	4226.2	10.4	Pt
	4209.1	10.5	Pt	4227.1	10.4	Pt
	4210.0	10.4	Pt	4228.0	10.2	Pt
	4212.2	10.4	Pt			
053068 S CAMELOPARDALIS—						
	4210.0	10.5	Pt			
053326 RR TAURI—						
	4201.2	12.7	B	4223.1	12.4	B
053337 RU AURIGAE—						
	4210.0	[12.0	Pt	4223.0	[12.0	Pt
	4207.2	13.7	Sg	4224.2	12.4	Sg
053531 U AURIGAE—						
	4174.6	[11.0	Ch	4223.0	13.3	Pt
053920 Y TAURI—						
	4168.8	8.0	Au	4180.8	7.8	Au
	4168.8	7.9	Au	4185.8	7.6	Au
	4171.8	7.9	Au	4185.8	7.5	Au
	4172.8	7.9	Au	4210.8	7.5	Au
	4172.8	7.8	Au	4210.8	7.5	Au
	4174.8	8.0	Au	4215.8	7.2	Au
	4174.8	7.8	Au	4215.8	7.4	Au
054319 SU TAURI—						
	4164.6	11.3	Ch	4212.2	10.3	Pt
	4171.5	10.9	Ch	4213.0	10.2	Pt
	4179.5	10.5	Ch	4215.0	10.2	Pt
	4191.7	10.6	L	4215.1	9.8	B
	4199.1	10.3	Wf	4216.0	10.2	Pt
	4200.1	10.7	Lv	4217.0	10.1	Pt
	4201.2	9.9	B	4217.2	10.3	Br
	4202.0	10.4	Pt	4217.2	10.4	Wf
	4203.1	9.7	Y	4222.2	10.0	Pt
	4203.1	10.3	Ly	4223.0	9.9	Pt
	4206.0	10.3	Ly	4223.1	9.6	Ly
	4207.2	9.9	B	4223.2	9.8	B
	4208.8	11.0	L	4226.0	9.8	Y
	4209.1	10.0	Lv	4226.1	10.0	Lv
	4209.1	10.4	Pt	4226.1	9.7	B
	4210.0	10.3	Pt	4226.2	10.0	Pt
	4210.2	10.5	Br	4227.1	10.0	Pt
	4211.2	10.2	Lv	4228.0	10.1	Pt
054231 S COLUMBAE—						
	4165.8	12.2	Sm	4176.5	12.3	Bl
	4167.5	12.3	Bl	4176.9	12.6	Sm
	4171.8	12.2	Sm			
054615a Z TAURI—						
	4203.1	[12.7	Y			
054615b RS TAURI—						
	4203.1	9.2	Y			
054615c RU TAURI—						
	4203.1	11.6	Y			
054629 R COLUMBAE—						
	4165.8	[12.4	Sm	4176.9	[12.4	Sm
	4167.5	[13.0	Bl			
054920a U ORIONIS—						
	4200.3	11.0	Sg	4223.1	12.2	Cy
	4201.2	10.2	B	4223.1	11.0	Gb
	4202.1	10.5	Gb	4224.1	11.1	B
	4204.1	10.8	Bi	4224.2	11.8	Sg
	4207.1	10.5	Al	4226.1	10.8	Al
	4210.2	11.4	Cy	4226.1	12.1	Cy
	4211.2	11.4	Lv	4226.1	12.2	Hy
	4212.2	10.1	B	4226.1	12.0	Em
	4217.1	10.8	B	4230.0	12.2	Cy
	4220.1	11.6	Bi			

VARIABLE STAR OBSERVATIONS RECEIVED DURING MARCH, 1925—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
054920b UW ORIONIS—						
	4204.1	10.7	Bi	4220.1	10.5	Bi
	4211.2	10.0	Lv	4223.1	10.4	Cy
	4210.2	10.6	Cy	4226.1	10.4	Cy
	4217.2	10.5	Cy	4230.0	10.4	Cy
054974 V CAMELOPARDALIS—						
	4199.2	14.2	Wf	4223.1	[13.3	B
	4202.2	[13.5	B	4226.1	[13	Y
055353 Z AURIGAE—						
	4174.6	10.6	Ch	4217.1	10.2	B
	4199.2	10.9	Wf	4224.1	9.8	B
	4206.1	10.7	B	4226.2	9.8	Pt
055686 R OCTANTIS—						
	4152.6	7.6	Bl	4171.9	8.3	Sm
	4159.5	7.5	Bl	4176.5	8.6	Bl
	4166.8	8.1	Sm	4176.9	8.5	Sm
	4167.5	8.3	Bl	4182.8	8.8	Sm
060450 X AURIGAE—						
	4153.6	11.3	Ch	4223.1	9.4	B
	4164.6	12.3	Ch	4226.2	9.0	Pt
	4207.2	10.4	B			
060547 SS AURIGAE—						
	4154.9	[11.6	Ch	4207.1	[13.0	Cd
	4164.6	[11.6	Ch	4208.8	[13.9	L
	4168.6	[11.6	Ch	4209.1	[14.0	Lv
	4171.5	[11.6	Ch	4210.2	[14.5	Br
	4172.5	[11.6	Ch	4211.2	[12.4	Sg
	4173.5	[12.4	Ch	4212.1	[12.5	Bi
	4175.5	[11.6	Ch	4213.0	[12.4	Pt
	4177.5	[11.6	Ch	4215.0	[12.4	Pt
	4178.6	[11.6	Ch	4215.1	[12.8	B
	4179.5	[11.6	Ch	4216.0	[12.4	Pt
	4180.5	[11.6	Ch	4217.1	[13.5	B
	4184.7	[12.4	L	4218.3	[13.9	Wf
	4185.8	[12.4	L	4220.3	[13.3	Wf
	4187.1	[13.3	L	4222.1	[14.0	Bi
	4191.8	[12.4	L	4223.1	[14.2	Bi
	4192.8	[14.5	L	4224.1	[13.3	B
	4193.8	[13.9	L	4225.1	[14.0	Bi
	4199.2	15.2	Wf	4226.1	[14.0	Lv
	4200.1	[13.8	Lv	4227.1	[12.0	Pt
	4202.0	[12.6	Pt	4228.0	[12.4	Pt
	4206.2	[12.4	Sg	4230.0	11.8	Cy
061647 V AURIGAE—						
	4223.2	10.6	B			
061702 V MONOCEROTIS—						
	4172.6	8.3	Ch	4205.4	7.1	Kk
	4194.4	7.3	Kk	4206.4	7.0	Kk
	4195.4	7.2	Kk	4207.4	7.2	Kk
	4196.4	7.0	Kk	4210.4	7.3	Kk
	4197.6	7.2	Kk	4226.0	7.0	Ya
	4204.4	7.0	Kk	4226.2	6.9	Pt
062808 Z MONOCEROTIS—						
	4174.8	9.3	Au	4210.8	8.6	Au
	4180.8	8.9	Au	4210.8	8.7	Au
	4180.8	8.9	Au	4215.9	8.8	Au
	4185.8	8.8	Au			
063159 U LYNCIS—						
	4226.1	10.7	Y			
063308 R MONOCEROTIS—						
	4223.2	11.6	B	4226.2	10.6	Pt
063558 S LYNCIS—						
	4177.6	9.0	Ch	4223.1	11.4	Ya
	4222.1	10.8	B	4226.2	11.8	Pt
064030 X GEMINORUM—						
	4222.1	[8.9				
064707 W MONOCEROTIS—						
	4226.1	9.6	B	4226.2	10.6	Pt
065111 Y MONOCEROTIS—						
	4200.2	11.3	Lv	4226.1	9.2	Y
	4209.2	10.4	Lv	4226.2	9.0	Pt
	4220.1	9.2	Bi			
065208 X MONOCEROTIS—						
	4168.8	8.9	Au	4185.2	9.1	Au
	4168.8	8.9	Au	4185.8	8.7	L
	4172.6	9.3	Ch	4206.8	7.5	L
	4172.8	8.9	Au	4210.8	7.5	Au
	4172.5	9.0	Au	4210.8	7.2	Au
	4174.8	9.0	Au	4215.8	7.2	Au
	4180.8	9.2	Au	4215.8	7.2	Au
	4180.8	9.1	Au			
065355 R LYNCIS—						
	4199.2	13.6	Wf			
070109 V CANIS MINORIS—						
	4172.6	[10.3	Ch			
070122a R GEMINORUM—						
	4169.6	8.3	Ch	4220.1	9.9	Bi
	4183.6	9.1	Ch	4222.2	9.8	B
	4193.4	9.1	Kk	4223.1	9.7	Al
	4199.2	9.2	Wf	4226.1	10.0	Ya
	4200.3	9.4	Sg	4226.1	10.5	Jo
	4203.1	9.5	Al	4228.0	10.6	Pt
	4211.2	10.0	Lv			
070122b Z GEMINORUM—						
	4211.2	12.6	Lv	4228.0	12.4	Pt
	4222.2	12.5	B			
070122c TW GEMINORUM—						
	4211.2	8.4	Lv	4222.2	8.3	B
	4220.1	8.2	Bi	4228.0	8.3	Pt
070310 R CANIS MINORIS—						
	4185.8	8.6	L	4222.2	9.4	B
	4206.8	8.7	L			
070772 R VOLANTIS—						
	4161.9	9.9	Ht	4175.8	10.1	Sm
	4165.8	9.9	Sm	4179.8	9.9	Ht
071201 RR MONOCEROTIS—						
	4172.6	11.0	Ch	4225.2	13.9	Bi
	4200.2	13.3	Lv	4226.2	13.8	Lv
	4209.2	13.5	Lv			
071713 V GEMINORUM—						
	4226.2	13.1	B	4228.0	10.4	Pt
072708 S CANIS MINORIS—						
	4158.6	8.8	Ch	4217.2	7.6	Cy
	4174.6	8.6	Ch	4220.1	7.2	B
	4185.8	8.7	L	4223.1	7.2	Al
	4201.2	8.4	Sg	4226.1	7.0	Al
	4203.1	8.4	Al	4226.1	6.7	Cd
	4206.8	8.1	L	4226.1	7.2	Ya
	4207.1	8.0	B	4228.0	7.0	Pt
072811 T CANIS MINORIS—						
	4207.2	[13.5	B			

VARIABLE STAR OBSERVATIONS RECEIVED DURING MARCH, 1925—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
073173 S VOLANTIS—						
	4152.5	10.5	Bl	4167.5	9.3	Bl
	4159.5	9.4	Bl	4176.5	9.2	Bl
073508 U CANIS MINORIS—						
	4185.8	8.9	L	4226.1	8.9	Ya
	4206.8	9.0	L	4226.1	9.0	Y
	4207.1	9.1	B	4228.0	8.6	Pt
	4220.1	8.9	B			
073723 S GEMINORUM—						
	4208.0	10.6	B	4228.0	9.3	Pt
074241 W PUPPIS—						
	4152.5	9.9	Bl	4171.8	11.9	Sm
	4159.5	10.7	Bl	4176.5	12.7	Bl
	4161.9	11.2	Ht	4176.8	12.2	Sm
	4165.8	11.6	Sm	4179.8	12.6	Ht
	4167.5	11.5	Bl			
074323 T GEMINORUM—						
	4228.0	9.6	Pt			
074922 U GEMINORUM—						
	4152.6	8.8	Ch	4193.8	[13.7	L
	4154.9	8.7	Ch	4199.2	13.8	Wf
	4155.7	8.9	Ch	4200.2	[13.5	Lv
	4156.6	9.1	Ch	4202.0	[13.7	B
	4158.6	9.4	Ch	4205.0	13.9	B
	4159.6	9.4	Ch	4207.1	[13.3	Y
	4164.6	9.8	Ch	4209.1	[13.3	Pt
	4167.7	12.5	Ch	4210.2	13.8	Br
	4168.6	[12.4	Ch	4211.2	[13.7	Lv
	4169.6	[12.4	Ch	4212.2	[12.4	Pt
	4171.6	[11.7	Ch	4213.0	[12.4	Pt
	4172.6	[11.7	Ch	4214.2	[13.7	Bi
	4173.5	[12.4	Ch	4215.0	[11.3	Pt
	4174.6	[12.4	Ch	4217.2	[10.9	Cy
	4175.5	[12.3	Ch	4218.3	13.8	Wf
	4176.6	[12.3	Ch	4220.3	[13.3	Wf
	4177.5	[12.3	Ch	4222.2	14.0	Bi
	4178.6	[12.3	Ch	4223.1	[13.3	Cy
	4179.5	[11.7	Ch	4225.1	14.0	Bi
	4180.5	[11.7	Ch	4226.1	14.0	Lv
	4182.5	[10.3	Ch	4226.1	13.7	Y
	4184.8	[13.3	L	4227.1	[11.3	Pt
	4187.1	[12.4	L	4228.0	[12.4	Pt
	4192.8	14.1	L	4230.2	[11.7	Cy
075612 U PUPPIS—						
	4215.1	11.5	B	4226.1	11.3	Y
	4223.1	10.9	Ya	4226.1	10.5	B
081112 R CANCRI—						
	4152.7	10.7	Ch	4208.8	7.9	L
	4167.6	10.1	Ch	4208.9	8.5	Kb
	4178.6	9.5	Ch	4209.2	8.1	Pt
	4191.8	8.9	L	4210.2	8.4	Cy
	4196.8	9.0	Kb	4223.1	7.0	Ly
	4198.9	8.8	Kb	4223.1	6.8	Cy
	4201.9	8.7	Kb	4226.1	7.0	Ly
	4203.1	9.0	Ly	4226.1	6.5	Ya
	4204.0	8.7	Kb			
081617 V CANCRI—						
	4152.7	8.9	Ch	4209.2	8.8	Pt
	4169.7	8.0	Ch	4210.2	9.2	Cy
	4178.6	8.2	Ch	4223.1	9.5	Cy
	4184.6	8.6	Ch			
082405 RT HYDRAE—						
	4209.2	7.6	Pt			
082476 R CHAMAELEONTIS—						
	4165.8	[12.4	Sm	4175.8	[12.4	Sm
	4167.6	[12.6	Bl			
083019 U CANCRI—						
	4199.2	11.2	Wf	4220.2	11.7	Bi
	4200.2	11.3	Lv	4223.1	11.5	Cy
	4210.2	11.4	Cy	4226.2	12.4	Lv
	4211.2	11.7	Lv			
083350 X URSAE MAJORIS—						
	4213.1	[12.7	B			
084808 S HYDRAE—						
	4152.7	8.0	Ch	4209.2	7.8	Pt
	4169.7	7.6	Ch	4217.2	7.6	Cy
	4178.7	7.2	Ch	4226.1	8.2	Ya
	4184.6	7.2	Ch			
085008 T HYDRAE—						
	4152.7	11.0	Ch	4208.8	12.4	L
	4169.7	11.8	Ch	4209.2	12.8	Pt
085120 T CANCRI—						
	4152.7	9.0	Ch	4209.2	7.6	Pt
	4169.7	8.8	Ch	4210.3	8.3	Cy
	4178.6	8.4	Ch	4223.2	8.7	Cy
090024 S PYXIDIS—						
	4209.2	9.8	Pt			
090151 V URSAE MAJORIS—						
	4206.1	10.4	B	4217.0	10.3	B
090425 W CANCRI—						
	4199.2	8.6	Wf	4223.2	9.1	Cy
	4210.3	8.8	Cy			
091868 RW CARINAE—						
	4171.5	[12.8	Bl			
092551 Y VELORUM—						
	4165.9	[12.4	Sm	4171.9	[12.9	Sm
	4171.5	[12.9	Bl	4181.9	[12.4	Sm
092962 R CARINAE—						
	4152.6	5.8	Bl	4176.5	6.9	Bl
	4159.5	6.1	Bl	4176.8	7.0	Sm
	4161.9	6.3	Ht	4179.8	7.6	Ht
	4165.9	6.6	Sm	4181.8	7.3	Sm
	4167.6	6.2	Bl			
093014 X HYDRAE—						
	4154.9	11.6	Ch	4209.2	9.4	Pt
	4169.7	11.2	Ch	4217.2	8.5	Cy
	4208.1	9.0	B			
093178 Y DRACONIS—						
	4209.2	11.0	Du	4226.1	13.6	Y
	4217.3	12.0	Cy			
093934 R LEONIS MINORIS—						
	4152.7	11.0	Ch	4209.2	8.9	Pt
	4167.7	11.2	Ch	4213.1	8.6	B
	4174.6	11.1	Ch	4217.3	7.8	Cy
	4183.7	10.8	Ch	4223.1	7.5	B
094211 R LEONIS—						
	4152.7	10.3	Ch	4211.2	8.8	Sg
	4174.6	9.8	Ch	4223.1	8.5	Ly
	4183.7	9.7	Ch	4223.2	7.8	Cy
	4203.1	9.5	Ly	4223.2	8.2	Al
	4203.2	8.9	Al	4224.2	8.0	Sg
	4203.6	8.9	Kk	4226.1	8.7	Ly

VARIABLE STAR OBSERVATIONS RECEIVED DURING MARCH, 1925—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
094211 R LEONIS—Continued.						
	4205.4	8.9	Kk	4230.2	7.5	Cy
	4208.0	9.4	Ly	4230.2	7.5	Hy
	4209.2	8.8	Pt			
094622 Y HYDRAE—						
	4209.2	6.3	Pt			
094953 Z VELORUM—						
	4152.6	8.0	Bl	4171.9	8.2	Sm
	4159.5	8.0	Bl	4176.5	8.4	Bl
	4161.9	8.2	Ht	4176.8	8.5	Sm
	4165.8	8.2	Sm	4179.8	8.5	Ht
	4167.6	8.1	Bl	4181.8	8.9	Sm
095421 V LEONIS—						
	4152.7	9.2	Ch	4209.2	12.8	Pt
	4178.7	11.5	Ch	4222.2	13.0	Bi
	4199.2	12.5	Wf	4225.2	12.5	Sg
	4206.1	12.9	B	4226.2	13.2	Lv
095563 RV CARINAE—						
	4171.5	[13.1	Bl			
095814 RY LEONIS—						
	4213.9	9.5	Kl	4222.8	9.6	Kl
	4221.8	9.6	Kl			
100661 S CARINAE—						
	4152.6	6.2	Bl	4171.8	5.5	Sm
	4159.5	5.5	Bl	4175.8	5.3	Sm
	4161.9	6.0	Ht	4176.5	5.8	Bl
	4165.8	5.8	Sm	4179.8	5.7	Ht
	4167.6	5.3	Bl	4181.8	6.0	Sm
101058 Z CARINAE—						
	4165.9	[12.3	Sm	4175.8	[12.3	Sm
	4171.5	[12.6	Bl			
101153 W VELORUM—						
	4152.6	10.6	Bl	4171.9	11.3	Sm
	4159.5	10.8	Bl	4176.5	11.2	Bl
	4166.8	11.1	Sm	4176.8	11.5	Sm
	4167.6	10.9	Bl	4181.8	11.5	Sm
103212 U HYDRAE—						
	4182.8	5.5	Kk	4202.6	5.8	Kk
	4184.8	5.8	Kk	4204.6	5.8	Kk
	4186.8	5.8	Kk	4203.6	5.8	Kk
	4195.6	5.6	Kk	4205.6	5.8	Kk
	4197.6	5.8	Kk	4216.6	5.9	Kk
103769 R URSAE MAJORIS—						
	4152.7	6.8	Ch	4208.2	8.3	B
	4167.7	6.9	Ch	4209.0	8.4	Du
	4178.7	6.8	Ch	4209.2	8.0	Pt
	4184.4	7.7	H	4210.2	8.4	Cy
	4185.4	7.6	H	4211.0	8.8	Ly
	4199.2	8.1	Wf	4217.9	8.3	Kl
	4200.1	7.9	Sg	4220.1	8.6	B
	4203.0	8.3	Ly	4223.0	8.7	Ly
	4203.1	8.2	Du	4223.2	8.8	Cy
	4203.1	8.0	Al	4224.2	8.6	Sg
	4205.1	8.3	Du	4227.0	8.7	Ly
	4208.0	8.5	Ly	4227.1	9.1	Ya
104620 V HYDRAE—						
	4152.6	11.2	Bl	4169.7	11.9	Ch
	4154.9	11.8	Ch	4176.5	11.4	Bl
	4159.5	10.6	Bl	4182.6	12.1	Ch
	4167.6	10.8	Bl	4209.2	11.3	Pt
104628 RS HYDRAE—						
	4171.5	[13.7	Bl			
104814 W LEONIS—						
	4201.1	13.0	B	4222.2	11.0	Cy
	4206.1	13.1	B	4226.1	10.6	Y
	4217.3	12.5	Cy	4228.0	12.5	Pt
	4222.1	11.8	B			
110361 RS CARINAE—						
	4168.8	[12.3	Sm	4171.9	[12.3	Sm
110506 S LEONIS—						
	4201.1	12.1	B	4222.1	10.5	B
	4206.1	11.8	B	4228.0	11.3	Pt
111561 RY CARINAE—						
	4171.5	[13.1	Bl			
111661 RS CENTAURI—						
	4152.6	12.3	Bl	4171.9	11.2	Sm
	4159.5	11.8	Bl	4175.8	10.8	Sm
	4165.8	11.6	Sm	4176.5	10.4	Bl
	4167.6	10.9	Bl	4181.6	9.7	Sm
	4168.8	11.6	Sm			
114441 X CENTAURI—						
	4152.6	12.0	Bl	4171.5	12.5	Bl
115058 W CENTAURI—						
	4171.5	[13.3	Bl			
115919 R COMAE—						
	4199.3	14.2	Wf	4226.2	13.4	Lv
120012 SU VIRGINIS—						
	4228.0	12.5	Pt			
121418 R CORVI—						
	4186.2	11.4	L	4228.0	13.0	Pt
122001 SS VIRGINIS—						
	4186.2	7.2	L	4213.1	8.4	B
	4205.2	7.6	L			
122532 T CANUM VENATICORUM—						
	4202.2	9.7	B	4228.0	9.5	Pt
122803 Y VIRGINIS—						
	4152.6	10.8	Bl	4176.5	11.9	Bl
	4159.5	10.6	Bl	4186.2	10.4	L
	4167.6	11.6	Bl	4213.2	10.3	B
122854 U CENTAURI—						
	4152.6	10.8	Bl	4167.6	10.6	Bl
	4159.5	10.6	Bl	4176.5	11.9	Bl
123160 R URSAE MAJORIS—						
	4169.7	[11.3	Ch	4213.1	[12.4	B
	4199.3	12.8	Wf	4228.0	12.5	Pt
	4202.2	12.8	B			
123307 R VIRGINIS—						
	4186.2	10.3	L	4228.0	6.6	Pt
	4213.2	7.6	B			
123459 RS URSAE MAJORIS—						
	4199.3	12.4	Wf	4223.0	9.8	Ly
	4202.2	11.5	B	4223.1	9.7	Sg
	4203.2	10.7	Al	4225.2	9.9	Cy
	4207.0	10.7	Cd	4226.1	9.5	Cd
	4207.1	11.5	Jo	4226.2	9.9	Al
	4209.3	10.5	Sg	4227.0	9.5	Ly
	4210.3	10.8	Cy	4230.2	8.9	Cy
	4213.1	10.2	B	4230.2	8.9	Hy
	4217.3	10.2	Cy			

VARIABLE STAR OBSERVATIONS RECEIVED DURING MARCH, 1925—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
123961 S URSAE MAJORIS—						
	4169.7	11.3	Ch	4213.8	8.7	Kl
	4189.2	11.0	L	4214.1	8.5	Jo
	4199.3	9.2	Wf	4216.8	8.4	Kl
	4203.0	9.5	Ly	4217.9	8.4	Kl
	4204.0	9.2	Kb	4221.8	8.4	Kl
	4207.1	8.8	Cd	4222.8	8.4	Kl
	4208.0	9.0	Ly	4223.1	8.0	Sg
	4208.8	8.9	L	4226.1	8.5	Jo
	4208.9	8.9	Kb	4226.1	7.4	Al
	4209.1	9.0	Du	4226.1	8.2	Cd
	4209.3	8.4	Sg	4228.0	8.0	Pt
	4211.0	8.8	Ly	4230.2	8.1	Cy
	4213.1	8.1	B	4230.2	8.2	Hy
124204 RU VIRGINIS—						
	4228.0	10.3	Pt			
124606 U VIRGINIS—						
	4228.0	9.8	Pt			
130212 RV VIRGINIS—						
	4199.3	[12.1	Wf	4217.3	[12.1	Wf
131383 U OCTANTIS—						
	4166.8	[12.9	Sm	4175.8	[12.9	Sm
	4169.9	13.2	Sm	4182.8	[12.4	Sm
	4171.5	13.4	Bl			
132422 R HYDRAE—						
	4167.6	7.8	Bl	4205.2	7.3	L
	4178.0	8.1	Ch	4205.8	8.4	Kk
	4179.6	7.3	Bl	4206.6	8.4	Kk
	4186.2	7.5	L	4207.6	8.3	Kk
	4204.6	8.4	Kk	4228.0	6.6	Pt
132706 S VIRGINIS—						
	4181.0	11.0	Ch	4207.6	9.2	Kk
	4199.3	10.6	Wf	4217.3	9.3	Cy
	4206.6	9.3	Kk	4228.0	8.6	Pt
133155 RV CENTAURI—						
	4152.6	8.3	Bl	4167.6	8.5	Bl
	4159.5	8.0	Bl	4176.5	8.2	Bl
133273 T URSAE MINORIS—						
	4199.3	8.8	Wf	4209.2	9.7	Du
133633 T CENTAURI—						
	4152.6	5.7	Bl	4179.6	7.8	Bl
	4167.6	6.0	Bl			
134236 RT CENTAURI—						
	4152.6	9.4	Bl	4179.6	8.7	Bl
	4167.6	8.8	Bl			
134440 R CANUM VENATICORUM—						
	4179.0	8.3	Kb	4204.0	8.7	Kb
	4194.9	8.5	Kb	4208.9	8.9	Kb
	4196.9	8.5	Kb	4210.9	8.8	Kb
	4201.9	8.8	Kb	4228.0	8.7	Pt
134536 RX CENTAURI—						
	4179.6	[13.1	Bl			
134677 T APODIS—						
	4152.6	9.5	Bl	4171.9	10.2	Sm
	4159.5	9.5	Bl	4176.5	10.3	Bl
	4166.8	9.8	Sm	4176.9	10.4	Sm
	4167.6	10.0	Bl	4182.8	10.3	Sm
135809 RR VIRGINIS—						
	4228.0	11.6	Pt			
140113 Z BOOTIS—						
	4199.3	9.9	Wf			
140528 RU HYDRAE—						
	4179.6	10.7	Bl			
140959 R CENTAURI—						
	4152.6	8.2	Bl	4175.9	8.3	Sm
	4159.5	8.0	Bl	4176.5	8.4	Bl
	4161.9	8.3	Ht	4179.9	9.2	Ht
	4167.6	8.4	Bl	4182.9	8.3	Sm
	4169.9	8.3	Sm			
141567 U URSAE MINORIS—						
	4154.0	8.1	Ch	4209.1	8.9	Du
	4181.0	8.2	Ch	4228.0	9.0	Pt
141954 S BOOTIS—						
	4199.1	13.2	Wf	4210.3	13.2	Pt
142539 V BOOTIS—						
	4181.0	8.1	Ch	4200.3	8.0	Sg
	4182.8	8.4	Kk	4202.6	8.6	Kk
	4184.8	8.1	Kk	4205.2	7.8	L
	4186.8	8.3	Kk	4206.6	8.7	Kk
	4187.2	8.1	L	4207.2	7.7	Al
	4190.8	8.4	Kk	4210.3	7.9	Pt
	4195.6	8.4	Kk	4217.4	8.4	Cy
	4199.8	8.4	Kk	4223.3	8.2	Cy
142584 R CAMELOPARDALIS—						
	4199.3	12.5	Wf			
143227 R BOOTIS—						
	4179.0	8.0	Ch	4199.8	8.6	Kk
	4184.8	8.4	Kk	4200.3	8.6	Sg
	4186.8	8.4	Kk	4207.2	8.7	Al
	4190.8	8.5	Kk	4210.3	9.3	Pt
145254 Y LUPIS—						
	4171.5	[12.8	Bl	4176.9	[11.9	Sm
145971 S APODIS—						
	4152.6	10.3	Bl	4171.9	10.0	Sm
	4159.5	10.3	Bl	4175.9	10.0	Sm
	4167.5	10.1	Bl	4176.5	10.3	Bl
	4168.9	10.0	Sm	4182.9	10.0	Sm
150018 RT LIBRAE—						
	4210.3	13.1	Pt			
151519 T LIBRAE—						
	4210.3	11.1	Pt			
150605 Y LIBRAE—						
	4186.2	9.0	L	4210.3	9.4	Pt
	4205.2	9.4	L			
151520 S LIBRAE—						
	4154.0	8.6	Ch	4186.2	9.7	L
	4176.0	9.1	Ch	4205.2	10.6	L
151714 S SERPENTIS—						
	4187.2	12.7	L			
151731 S CORONAE BOREALIS—						
	4175.9	8.0	Ch	4205.8	9.0	Kk
	4186.8	8.8	Kk	4210.3	8.8	Pt
	4197.6	8.9	Kk	4223.2	9.7	Cy
151822 RS LIBRAE—						
	4179.7	11.5	Bl	4187.2	11.7	L
152714 RU LIBRAE—						
	4186.2	8.7	L	4210.3	10.1	Pt
152849 R NORMAE—						
	4167.6	12.6	Bl	4179.7	12.2	Bl
153020 X LIBRAE—						
	4179.7	11.5	Bl			

VARIABLE STAR OBSERVATIONS RECEIVED DURING MARCH, 1925—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
153215 W LIBRAE—						
	4179.7	[13.5	Bl			
153378 S URSAE MINORIS—						
	4199.3	9.8	Wf	4210.3	8.6	Pt
	4200.3	9.0	Sg	4223.2	8.7	Cy
	4207.2	9.3	Al	4225.2	8.5	Sg
	4209.0	9.7	Du			
153620a U LIBRAE—						
	4179.7	9.7	Bl			
154020 Z LIBRAE—						
	4179.7	[12.7	Bl			
154428 R CORONAE BOREALIS—						
	4154.9	6.2	Ch	4202.1	6.1	Pt
	4180.9	6.1	Ch	4202.6	6.2	Kk
	4183.8	5.7	Kk	4203.1	6.2	Al
	4185.2	5.9	L	4204.6	6.2	Kk
	4185.8	5.8	Kk	4205.6	5.9	Kk
	4186.2	6.0	L	4206.6	6.0	Kk
	4186.8	5.8	Kk	4207.6	6.1	Kk
	4187.2	5.9	L	4210.3	6.1	Pt
	4189.2	6.0	L	4210.3	6.3	Cy
	4189.8	5.7	Kk	4212.4	6.2	Pt
	4190.8	5.7	Kk	4213.4	6.1	Pt
	4190.8	6.1	Kd	4216.4	6.2	Pt
	4192.8	6.0	Kk	4217.3	6.3	Cy
	4195.6	5.9	Kk	4222.2	6.2	Pt
	4196.9	6.2	Kd	4223.1	6.0	Gb
	4196.8	6.0	Kk	4223.2	6.3	Cy
	4197.6	6.1	Kk	4225.3	6.2	Pt
	4199.8	5.9	Kk	4226.2	6.2	Pt
	4200.3	6.2	Sg	4226.2	6.2	Al
154615 R SERPENTIS—						
	4154.0	8.5	Ch	4210.3	6.7	Pt
	4176.0	6.4	Ch			
154639 V CORONAE POREALIS—						
	4210.3	8.5	Pt			
154715 R LIBRAE—						
	4210.3	11.0	Pt			
155018 RR LIBRAE—						
	4154.0	[10.9	Ch	4187.2	13.2	L
	4176.0	[11.9	Ch			
155823 RZ SCORPII—						
	4210.3	10.7	Pt			
160021 Z SCORPII—						
	4179.7	10.7	Bl	4186.2	10.9	L
160118 R HERCULIS—						
	4176.0	9.7	Ch	4210.3	10.8	Pt
160210 U SERPENTIS—						
	4210.3	10.3	Pt	4217.3	9.5	Cy
160325 SX HERCULIS—						
	4185.2	8.5	L	4213.4	8.9	Pt
	4202.4	8.8	Pt	4216.4	8.7	Pt
	4210.3	8.7	Pt	4225.3	8.0	Pt
	4212.4	8.8	Pt	4226.2	8.0	Pt
160519 W SCORPII—						
	4179.7	[12.8	Bl			
160625 RU HERCULIS—						
	4185.2	13.9	L			
161122a R SCORPII—						
	4179.7	[12.6	Bl			
161122b S SCORPII—						
	4179.7	12.6	Bl	4210.4	11.5	Pt
161138 W CORONAE BOREALIS—						
	4210.4	10.9	Pt			
161607 W OPHIUCHI—						
	4178.0	11.5	Ch	4210.4	12.8	Pt
	4187.2	11.9	L			
162112 V OPHIUCHI—						
	4210.4	7.3	Pt			
162119 U HERCULIS—						
	4210.4	11.7	Pt			
162807 SS HERCULIS—						
	4187.2	8.7	L	4210.4	11.5	Pt
162815 T OPHIUCHI—						
	4179.7	12.7	Bl	4210.4	11.6	Pt
162816 S OPHIUCHI—						
	4179.7	[12.6	Bl			
163137 W HERCULIS—						
	4210.4	13.6	Pt			
163226 R DRACONIS—						
	4177.0	8.9	Ch	4210.4	10.8	Pt
164319 RR OPHIUCHI—						
	4187.2	9.4	L	4210.4	10.3	Pt
164844 RS SCORPII—						
	4179.7	9.8	Bl			
165030 RR SCORPII—						
	4179.7	7.6	Bl			
165202 SS OPHIUCHI—						
	4210.4	11.6	Pt			
165631 RV HERCULIS—						
	4210.4	10.1	Pt			
165636 RT SCORPII—						
	4179.7	[13.0	Bl			
170215 R OPHIUCHI—						
	4210.4	11.4	Pt			
170833 RW SCORPII—						
	4179.6	[12.6	Bl			
171401 Z OPHIUCHI—						
	4210.4	8.7	Pt			
171723 RS HERCULIS—						
	4210.4	11.9	Pt			
172486 S OCTANTIS—						
	4152.6	9.2	Bl	4167.6	8.8	Bl
	4159.5	9.1	Bl	4176.5	9.1	Bl
	4161.9	9.1	Ht	4179.8	9.1	Ht
172809 RU OPHIUCHI—						
	4210.4	11.4	Pt			
173411 RT SERPENTIS—						
	4185.2	9.7	L			
173543 RU SCORPII—						
	4179.7	11.7	Bl			
174135 SV SCORPII—						
	4179.7	11.5	Bl			
174162 W PAVONIS—						
	4179.7	[13.0	Bl			
174406 RS OPHIUCHI—						
	4210.4	11.3	Pt			
175519 RY HERCULIS—						
	4176.0	8.7	Ch	4201.4	9.8	Pt
175654 V DRACONIS—						
	4210.4	12.5	Pt			

VARIABLE STAR OBSERVATIONS RECEIVED DURING MARCH, 1925—Continued.

Star	J.D.	Est.Obs.	J.D.	Est.Obs.
180531 T HERCULIS—				
	4176.0	8.3 Ch	4192.8	8.5 Kk
	4182.8	8.5 Kk	4195.8	8.4 Kk
	4183.8	8.4 Kk	4199.8	8.5 Kk
	4184.8	8.3 Kk	4202.8	8.5 Kk
	4185.2	8.1 L	4205.2	8.5 L
	4185.8	8.3 Kk	4205.8	8.6 Kk
	4186.8	8.3 Kk	4207.6	8.8 Kk
	4189.8	8.4 Kk	4210.4	8.7 Pt
	4190.8	8.5 Kk		
180911 NOVA OPHIUCHI—				
	4210.4	13.5 Pt		
181103 RY OPHIUCHI—				
	4210.4	13.0 Pt		
181136 W LYRAE—				
	4185.2	8.8 L	4210.4	8.5 Pt
	4207.6	8.5 Kk		
182133 RV SAGITTARII—				
	4179.7	7.7 Bl		
182224 SV HERCULIS—				
	4185.2	11.0 L		
182306 T SERPENTIS—				
	4210.4	11.5 Pt		
183308 Z OPHIUCHI—				
	4185.2	6.6 L	4210.4	7.7 Pt
	4205.2	7.1 L		
184134 RY LYRAE—				
	4210.4	12.1 Pt		
184205 R SCUTI—				
	4183.0	6.1 Ch	4196.8	5.6 Kk
	4183.8	6.0 Kk	4196.9	5.5 Kd
	4183.9	5.9 Kd	4199.8	5.4 Kk
	4184.8	6.0 Kk	4202.8	5.3 Kk
	4185.2	5.8 L	4205.2	5.0 L
	4185.8	5.9 Kk	4205.8	5.2 Kk
	4186.8	5.9 Kk	4210.4	5.2 Pt
	4189.8	5.8 Kk	4212.4	5.2 Pt
	4190.8	5.7 Kk	4213.4	5.0 Pt
	4190.8	6.9 Kd	4216.4	5.2 Pt
	4192.8	5.6 Kk	4217.4	5.3 Cy
	4195.8	5.7 Kk		
184300 NOVA AQUILAE—				
	4210.4	10.7 Pt	4216.4	10.7 Pt
	4213.4	10.6 Pt		
185032 RX LYRAE—				
	4183.0	[12.5 Ch	4210.4	12.5 Pt
185437a S CORONAE AUSTRALIS—				
	4179.8	11.5 Bl		
185537a R CORONAE AUSTRALIS—				
	4179.8	12.2 Bl		
185537b T CORONAE AUSTRALIS—				
	4179.8	[12.5 Bl		
185634 Z LYRAE—				
	4210.4	10.9 Pt		
185737 RT LYRAE—				
	4182.0	[11.0 Ch		
190108 R AQUILAE—				
	4210.4	6.9 Pt		
190926 X LYRAE—				
	4210.4	9.0 Pt		
190933a RS LYRAE—				
	4210.4	12.1 Pt		
190941 RU LYRAE—				
	4210.4	13.2 Pt		
190967a U DRACONIS—				
	4210.4	11.1 Pt		
191033 RY SAGITTARII—				
	4179.8	7.6 Bl		
191331 SW SAGITTARII—				
	4179.8	7.6 Bl		
191350 TZ CYGNI—				
	4210.4	10.4 Pt		
191637 U LYRAE—				
	4210.4	9.6 Pt		
192745 AF CYGNI—				
	4182.8	8.0 Kk	4195.8	7.6 Kk
	4184.8	7.9 Kk	4199.8	7.9 Kk
	4185.8	7.9 Kk	4202.8	7.8 Kk
	4186.8	7.8 Kk	4205.8	7.6 Kk
	4190.8	7.8 Kk	4207.8	7.6 Kk
	4192.8	7.8 Kk		
193311 RT AQUILAE—				
	4210.4	9.8 Pt		
193449 R CYGNI—				
	4176.0	11.3 Ch	4210.4	11.8 Pt
	4199.1	9.2 Wf	4217.4	12.0 Pt
193509 RV AQUILAE—				
	4210.4	13.5 Pt		
193972 T PAVONIS—				
	4166.8	[12.1 Sm	4179.7	[13.2 Bl
	4175.8	[12.1 Sm		
194048 RT CYGNI—				
	4210.4	7.9 Pt	4217.4	8.4 Cy
194348 TU CYGNI—				
	4154.5	9.4 Ch	4210.4	12.5 Pt
194604 X AQUILAE—				
	4210.4	11.0 Pt		
194632 x CYGNI—				
	4154.5	6.0 Ch	4190.8	7.2 Kk
	4159.5	6.0 Ch	4192.8	7.3 Kk
	4168.5	6.0 Ch	4199.8	7.2 Kk
	4181.0	6.0 Ch	4202.8	7.2 Kk
	4186.8	7.3 Kk	4210.4	7.8 Pt
195142 RU SAGITTARII—				
	4152.5	6.9 Bl	4179.8	7.5 Bl
	4159.5	7.2 Bl		
195553 NOVA CYGNI—				
	4210.4	12.2 Pt	4225.3	12.3 Pt
	4216.4	12.3 Pt		
195849 Z CYGNI—				
	4212.4	10.5 Pt		
195855 S TELESCOPII—				
	4167.5	[12.6 Bl		
200212 SY AQUILAE—				
	4212.4	11.0 Pt		
200357 S CYGNI—				
	4199.1	14.9 Wf		
200715b RW AQUILAE—				
	4212.4	9.3 Pt	4212.4	10.4 Pt

VARIABLE STAR OBSERVATIONS RECEIVED DURING MARCH, 1925—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
200747 R TELESCOPII—						
	4152.5	11.2	Bl	4167.5	9.8	Bl
	4159.5	10.0	Bl	4179.8	8.3	Bl
200906 Z AQUILAE—						
	4212.4	10.4	Pt			
200938 RS CYGNI—						
	4154.5	7.0	Ch	4183.0	7.4	Ch
	4164.5	7.0	Ch	4189.2	6.9	L
	4168.5	7.0	Ch	4212.4	7.3	Pt
	4178.0	7.2	Ch	4217.4	7.5	Cy
201008 R DELPHINI—						
	4212.4	12.0	Pt			
201437 WX CYGNI—						
	4217.4	11.3	Cy			
201647 U CYGNI—						
	4168.5	9.0	Ch	4212.4	8.9	Pt
202240 U MICROSCOPII—						
	4152.5	9.4	Bl	4159.5	9 4	Bl
202946 SZ CYGNI—						
	4202.4	9.6	Pt	4216.4	9.3	Pt
	4210.4	8.8	Pt	4222.4	8.8	Pt
	4212.4	9.3	Pt	4225.3	9.0	Pt
	4213.4	9.6	Pt			
202954 ST CYGNI—						
	4212.4	12.0	Pt			
203226 V VULPECULAE—						
	4212.4	8.8	Pt			
203429 R MICROSCOPII—						
	4152.5	10.7	Bl			
203816 S DELPHINI—						
	4212.4	9.0	Pt			
203847 V CYGNI—						
	4154.5	8.0	Ch	4173.5	8.2	Ch
	4159.5	7.9	Ch	4180.5	8.3	Ch
	4164.5	8.0	Ch	4212.4	12.8	Pt
	4168.5	8.1	Ch			
204954 S INDI—						
	4167.5	11.9	Bl	4176.5	10.8	Bl
205923 R VULPECULAE—						
	4213.4	12.6	Pt			
210124 V CAPRICORNI—						
	4152.5	10.7	Bl			
213868 T CEPHEI—						
	4164.6	10.6	Ch	4213.4	12.6	Pt
212030 S MICROSCOPII—						
	4152.5	9.9	Bl	4159.5	9.5	Bl
213244 W CYGNI—						
	4190.9	6.6	Kd	4196.9	6.2	Kd
213678 S CEPHEI—						
	4202.0	8.4	Pt			
213753 RU CYGNI—						
	4213.4	8.4	Pt			
213843 SS CYGNI—						
	4152.6	[10.9	Ch	4182.5	[9.6	Ch
	4153.6	10.8	Ch	4163.5	[9.8	Ch
	4154.5	10.7	Ch	4184.8	11.9	L
	4155.5	9.8	Ch	4185.5	[10.9	Ch
	4156.6	9.8	Ch	4185.8	12.0	L
	4158.6	9.5	Ch	4189.2	12.0	L
	4159.5	9.2	Ch	4191.8	11.9	L
	4160.5	8.7	Ch	4192.8	12.1	L
213843 SS CYGNI—Continued.						
	4162.6	8.7	Ch	4193.8	12.0	L
	4164.5	9.2	Ch	4199.1	11.8	Wf
	4167.5	11.0	Ch	4202.4	11.6	Pt
	4168.5	11.2	Ch	4205.2	12.0	L
	4171.5	11.9	Ch	4208.8	12.0	L
	4172.5	[10.9	Ch	4210.4	11.6	Pt
	4173.5	12.0	Ch	4212.4	10.8	Pt
	4174.5	11.9	Ch	4213.4	10.1	Pt
	4175.5	11.9	Ch	4216.4	9.2	Pt
	4177.5	11.9	Ch	4216.1	9.0	Wf
	4178.6	[10.9	Ch	4217.1	8.4	Wf
	4179.5	[10.9	Ch	4218.1	8.3	Wf
	4180.5	[10.0	Ch	4222.4	8.8	Pt
213937 RV CYGNI—						
	4213.4	6.6	Pt			
214024 RR PEGASI—						
	4213.4	10.6	Pt			
214247 R GRUIS—						
	4161.8	[11.6	Ht	4167.5	13.1	Bl
	4165.8	[11.6	Sm			
215934 RT PEGASI—						
	4213.4	11.3	Pt			
220133a RY PEGASI—						
	4213.4	9.0	Pt			
220412 T PEGASI—						
	4168.5	[11.1	Ch			
221938 T GRUIS—						
	4165.8	10.1	Sm			
221948 S GRUIS—						
	4161.8	8.2	Ht	4171.8	8.1	Sm
	4165.8	8.1	Sm	4176.8	8.3	Sm
222867 R INDI—						
	4167.5	[13.5	Bl			
223462 T TUCANAE—						
	4161.8	8.1	Ht	4171.8	8.6	Sm
	4165.8	8.3	Sm	4176.8	8.4	Sm
223841 R LACERTAE—						
	4199.1	12.5	Lv			
230110 R PEGASI—						
	4148.1	8.7	Ls			
230759 V CASSIOPEIAE—						
	4195.4	9.4	Kk	4207.4	8.0	Kk
	4201.2	8.5	Sg	4210.4	7.9	Kk
	4205.4	8.8	Kk	4223.0	7.5	Pt
	4206.4	7.9	Du	4226.0	7.5	Ya
231425 W PEGASI—						
	4168.6	7.3	Ch	4199.1	10.5	Lv
232746 V PHOENICIS—						
	4161.8	10.8	Ht	4171.8	11.3	Sm
	4165.8	10.8	Sm	4176.8	12.0	Sm
232848 Z ANDROMEDAE—						
	4167.7	8.7	Ch	4223.0	9.6	Pt
233335 ST ANDROMEDAE—						
	4168.6	9.4	Ch	4223.0	10.7	Pt
233815 R AQUARII—						
	4156.5	9.4	Ch	4174.6	8.8	Ch
	4164.6	9.2	Ch	4183.5	8.6	Ch
235053 RR CASSIOPEIAE—						
	4172.6	[10.2	Ch			

VARIABLE STAR OBSERVATIONS RECEIVED DURING MARCH, 1925—Continued.

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
235209 V CETI—						
	4167.5	12.1	Bl	4192.8	10.4	L
	4176.5	11.6	Bl			
235265 R TUCANAE—						
	4165.8	[12.9	Sm	4171.8	[12.9	Sm

Star	J.D.	Est.	Obs.	J.D.	Est.	Obs.
235350 R CASSIOPEIAE—						
	4203.0	9.5	Ly	4227.0	8.2	Ly
	4223.0	8.5	Ly	4226.0	7.7	Ya
235939 SV ANDROMEDAE—						
	4199.1	9.5	Lv	4223.0	8.9	Pt
	4207.0	8.8	Y			

Observers, 30. Number of observations, 1450. Number of stars, 322.

The following observers have contributed to this report: Messrs. Allen, "Al"; Aurino, "Au"; Baldwin, "Bl"; Berman, "Bi"; Bouton, "B"; Brocchi, "Br"; Chandler, "Cd"; Chandra, "Ch"; Cilley, "Cy"; Dunham, "Du"; Elmer, "Em"; Gaebler, "Gb"; Hama, "H"; Henry, "Hy"; Houghton, "Ht"; Kanda, "Kd"; K. Kasai, "Kk"; Jones, "Jo"; Koelbloed, "Kb"; Kohl, "Kh"; Lacchini, "L"; Mrs. Leavens, "Ls"; Leavenworth, "Lv"; Mrs. Lytle, "Ly"; Smith, "Sm"; Peltier, "Pt"; Skaggs, "Sg"; Waterfield, "Wf"; Yalden, "Ya"; and Miss Young, "Y."

LEON CAMPBELL, Recording Secretary.

April 7, 1925.

COMET AND ASTEROID NOTES.

New Comet *c* 1925 (Orkisz).—A cablegram from Copenhagen to Harvard College Observatory announced the discovery of a comet by Orkisz at Mont Lysin on April 4. The comet was of the ninth magnitude, in the constellation Pegasus, in the approximate position $\alpha = 22^h\,47^m$, $\delta = +16°\,14'$. The comet is moving nearly due north,—slightly east. The following observed positions are at hand:

OBSERVATIONS OF ORKISZ' COMET *c* 1925.

1925	G. C. T. h	m		α h	m	s	δ °	′	″	Observer	Place
April	5	2 52.7	a	22	26	45.14	+16	37	19.2	Moeller	Copenhagen
	6	2 32.1	a	22	27	42.38	+17	38	41.6	Vinter-Hansen	Copenhagen
	6	2 43.4	a	22	27	42.92	+17	39	09.8	Moeller	Copenhagen
	6.5367		m	22	28	09.2	+18	06	04	Jeffers	Mt. Hamilton
	7.3671		ag	22	29	01.7	+19	01	28	Burton	Washington
	7.4356		a	22	29	02.2	+19	03	00	VanBiesbroeck	Wms. Bay
	7.5132		m	22	29	08.1	+19	08	09	Jeffers	Mt. Hamilton
	8.4580		a	22	30	07.9	+20	07	04	Gallo	Tacubaya

a = apparent place; m = mean place for 1925.0; ag = astrographic place for 1925.0.

A Harvard photograph of short exposure on April 6 shows the comet as a nebulous object, 1′ in diameter, and without tail or conspicuous nucleus.

Preliminary elements of the orbit of this comet have been computed by Shea and Alexeievsky, of the Students' Observatory at Berkeley, California, from observations on April 5, 6 and 7.

ELEMENTS OF ORKISZ' COMET *c* 1925.

T	= time of perihelion	1925, March 28.39 G. C. T.
ω	= perihelion — node	31° 04′
Ω	= longitude of node	327 07
i	= inclination	98 35
q	= perihelion distance	1.111

EPHEMERIS.

1925	α h m s	δ ° ′
April 10	22 31 42	+21 50
14	22 36 09	+26 22
18	22 41 02	+31 07
22	22 46 28	+36 04

The comet was observed at Northfield April 28.25 G. C. T. in approximate position $22^h\ 57^m.5 + 44°\ 39'$. It is much brighter than when discovered, has begun to develop a tail and will be a circumpolar object for some time now to observers in our latitude.

The following elements and ephemeris, given in the British Association Circular No. 5, received just as this issue of POPULAR ASTRONOMY goes to press, represent the observations of April 16 and 28 closely. According to these the comet is now at about its brightest and will during May be passing between Cassiopeia and the north celestial pole.

ELEMENTS COMPUTED BY G. MERTON.

T = 1925 April 1.2904 G. C. T.
ω = 35° 55′ 17″
Ω = 318 01 25 } 1925.0
i = 99 57 23
log q = 0.045126

EPHEMERIS.

G. C. T.	α h m s	δ ° ′	log r	log Δ
May 3	23 07 31	+51 04.8	0.087	0.170
11	23 31 53	+62 02.5	0.108	0.172
19	0 17 14	+72 17.2	0.130	0.185
27	2 10 57	+80 18.8	0.153	0.207
June 4	6 13 29	+81 43.4	0.176	0.236
12	8 31 18	+76 44.9	0.200	0.269
20	9 24 13	+70 58.2	0.222	0.302

Orbit of Schajn's Comet *a* 1925.—The fact that this comet moves so slowly and so near the ecliptic renders the determination of the elements of its orbit extremely uncertain. The following appear to be the best elements received at this writing (April 21). They were calculated by Prescott and Kaster, students at the Astronomical Observatory, Berkeley, California, from observations on March 23, 26 and 28. Alongside with these are placed elements computed by Professor Kobold of Kiel, Germany, which agree closely as to the node and inclination but differ widely in the other elements.

	Prescott and Kaster	Kobold
T = time of perihelion	1925, Sept. 17.37	1926 Jn. 7.595 G. C. T.
ω = perihelion — node	207° 38′	233° 39′.65 }
Ω = longitude of node	357 30	357 32.86 } 1925.0
i = inclination	146 28	144 51.92 }
q = perihelion distance	4.142	3.425

An observation on April 1 at the Yerkes Observatory was represented very closely by an ephemeris computed from the elements by Prescott and Kaster. No good ephemeris it at hand for May.

The following observations have come to hand from various sources:

OBSERVATIONS OF SHAJN'S COMET *a* 1925.

1925	G. C. T.		α	δ	Observer	Place
	h m s		h m s	° ′ ″		
Mar. 23	22 43 38	m	11 47 48.9	+1 43 49	Schorr	Bergedorf
24	20 22 00	m	11 46 10.9	+1 48 12	Schorr	Bergedorf
25	18 46 11	a	11 44 30.0	+1 52 49		Pulkova
25	23 42 20	a	11 44 08.36	+1 53 46.1	Vinter-Hansen	Copenhagen
26	6 12 23	m	11 43 38.3	+1 55 14	Jeffers	Lick
27	3 47.8	a	11 42 01.8	+1 59 25	Pitman	Swarthmore
27	22 54.9	a	11 40 35.99	+2 03 19.1	Krumpholz	Vienna
27	23 37.5	m	11 40 31.1	+2 03 30	Steavenson	Norwood
28.3676		m	11 39 51.1	+2 05 22	Fox	Evanston
28	19 46.3	a	11 39 02.5	+2 07 28	Bianchi	Milan
29	0 22.0	m	11 38 39.6	+2 08 49	Steavenson	Norwood
29.2218		m	11 38 18.5	+2 09 31	Fox	Evanston
29.2760		m	11 38 12.4	+2 09 43	Comrie	Evanston
30	23 57.9	m	11 35 08.30	+2 17 56.8	Mündler	Königstuhl
Mar. 31	23 53.8	a	11 33 23.51	+2 22 26.1	Hoffmeister	Sonneberg
April 2	1 55.6	m	11 31 26.2	+2 27 37	Steavenson	Norwood
3.5939	(4.0939?)		11 27 56.6	+2 35 46	Castro	Santiago
23.1793		ag	10 57 38.13	+3 48 00.0	Wilson	Northfield

a = apparent place; m = mean place for 1925.0; ag = astrographic place for 1925.0.

Orbit of Reid's Comet *b* 1925.—The best elements of the orbit of Reid's comet which are at hand (April 20) are probably those computed by Messrs J. Johannsen and Bengt Strömgren of Copenhagen, from observations March 24, 29 and April 3. The comet was observed, near the ephemeris place, at Northfield April 28, but the comparison star was not found in catalogues at hand.

ELEMENTS OF ORBIT OF COMET *b* 1925.

Computed by Johannsen and Strömgren.

T = time of perihelion	1925 July 29.653 G. C. T.	
ω = perihelion — node	256° 56′.12	1925.0
Ω = longitude of node	6 24.08	1925.0
i = inclination	27 42.16	1925.0
q = perihelion distance	1.687	

EPHEMERIS.

	α 1925.0	δ 1925	log r	log Δ	Mag.
	h m s	° ′			
April 6	13 17 12	—23 24.9	0.3506	0.1032	7.9
10	13 12 05	—24 27.6	0.3444	0.0904	
14	13 06 36	—25 29.6	0.3381	0.0789	
18	13 00 48	—26 30.4	0.3319	0.0688	
22	12 54 48	—27 29.6	0.3257	0.0600	
26	12 48 43	—28 26.9	0.3195	0.0528	
30	12 42 41	—29 21.9	0.3134	0.0470	
May 4	12 36 49	—30 14.6	0.3074	0.0427	
8	12 31 15	—31 05.0	0.3014	0.0398	
12	12 26 06	—31 53.2	0.2956	0.0381	
16	12 21 28	—32 39.5	0.2898	0.0376	
20	12 17 26	—33 24.2	0.2842	0.0382	7.2

OBSERVATIONS OF REID'S COMET *b* 1925.

1925	G. C. T.		α			δ			Observer	Place
	h	m	h	m	s	°	′	″		
Mar. 28	2	49.0	a	13	26	54.5	—21	06	15	Gonnessiat	
28	1	09.4	m	13	26	56.9	—21	05	13	Steavenson	Norwood
28	21	59.8	a	13	26	08.9	—21	18	36	Bianchi	Milan
29	1	23.3	m	13	25	58.6	—21	20	45	Steavenson	Norwood
29	4	30.4	ag	13	27	14.6	—21	19	12	Bower	Washington
29	22	59.5	a	13	25	06.55	—21	34	39.5	Vinter-Hansen	Copenhagen
29	23	28.3	a	13	25	05.56	—21	34	59.6	Möller	Copenhagen
30	0	45.0	a	13	25	02.50	—21	35	50.4	Godard	Bordeaux
30	21	57.9	a	13	24	08.30	—21	49	42.3	Bianchi	Milan
31	0	11.5	a	13	24	01.3	—21	51	16	Rougier	Strasburg
31	0	19.5	m	13	25	58.6	—21	51	16	Mündler	Konigstühl
April 2	1	06.4	m	13	21	47.7	—22	22	50	Steavenson	Norwood
3	23	34.2	a	13	19	37.70	—22	53	09.8	Vinter-Hansen	Copenhagen
3	23	54.5	a	13	19	36.62	—22	53	26.4	Möller	Copenhagen

a = apparent place; m = mean place for 1925.0; ag = astrographic place for 1925.0.

Discovery of Comet Shajn. —There has been some confusion in astronomical literature concerning the discovery of Comet 1925a (Shajn). Readers of POPULAR ASTRONOMY will, therefore, be interested to read the following extract from a letter which I have just received from Mr. G. Shajn, the discoverer. Although he did not intend this for publication, I think he could have no objection to its appearing in print. It should be added that Mr. Shajn, who was for several years a member of the staff of the Pulkovo Observatory in Russia, was recently transferred to the branch station of Pulkovo at Simeis, in the Crimea. The Simeis Observatory was founded in 1908 by the generosity of Mr. N. Maltzoff, who at that time was a man of considerable fortune, to supplement the activities of the Pulkovo Observatory in a milder climate (Latitude 44° 24′). S. I. Beliavsky has been its director for many years. It is opening an era of enlarged activity, inasmuch as the reflecting telescope of one meter aperture, ordered before the war from Sir Howard Grubb, has arrived and is now in process of erection. Mr. Shajn writes me as follows about his discovery: "The first four nights which I spent at Simeis were cloudy. During the fifth night it suddenly cleared up about midnight. I was not on duty but decided to make a trial exposure with the astrograph. By chance I set at $\alpha = 12^h\,0^m$; $\delta = 0°\,0'$. I guided by Metcalf's method but, not being used to the instrument, I moved the eyepiece in the wrong direction. Therefore all asteroids should have come out as trails twice as long as the star trails. After developing I noticed my mistake and did not even try to search the plates carefully. However, two asteroids were present on my plates—Echo and Liberatrix. Besides I noticed an object of the eleventh magnitude which was later identified as a comet. This object had a motion of nearly 30′ a day, that is about the double of what asteroids usually have at opposition. Had I not made the mistake in guiding, the trail of the comet would have had nearly the same length as the star trails and I doubt that I would have distinguished it from a star. . . . The comet was found on my first trial plate taken at Simeis . . . "

Yerkes Observatory, April 22, 1925. OTTO STRUVE.

GENERAL NOTES

Two Giant Gaseous Nebulae. — The Large Magellanic Cloud and the spiral nebula Messier 33 each contain one abnormally large and luminous gaseous nebula. Hubble's provisional estimate of the parallax of the spiral (*Science*, **61**, 279, 1925) and the Harvard photometric work on the Magellanic Clouds, together with published (H. C. 257) and unpublished measures for Messier 33, permit a direct comparison of the absolute dimensions and luminosities of these two large bright-line nebulae.

Both of the gaseous nebulae bear separate catalogue numbers. N. G. C. 2070 = 30 Doradus, the brightest gaseous nebula in the Large Cloud, has been described in some detail in Harvard Circulars 268 and 271. N. G. C. 604, the irregular nebula at the end of one of the spiral arms of Messier 33, is 10′ from the nucleus of the spiral, north following. Its bright-line spectrum has been observed by Slipher, Pease and Adams, and others. The radial velocity is about —270 km/sec., according to measures made at Mount Wilson and Flagstaff. The radial velocity of 30 Doradus is +275 km/sec.

The following comparisons of the nebulae are necessarily rough, because of obvious difficulties of measurement. The Orion Nebula is included in the comparison as a representative not only of the large galactic gaseous nebulae, but also as typical, in dimensions and brightness, of all the ordinary gaseous nebulae in the Magellanic Clouds. The tabulated diameters are based on photographs that are of comparable exposure when allowance is made for the differences in distance. The maximum diameters for the Orion Nebula and 30 Doradus are at least twice as great with the most favorable exposures, and possibly the same would be true for N. G. C. 604. For the latter the mean angular diameter, 43″, is derived from reproductions of photographs made at the Lick and Mount Wilson Observatories. The apparent magnitudes were determined from Harvard plates made with various telescopes.

	N. G. C. 2070	N. G. C. 604	Orion Nebula
Apparent photographic magnitude	3.7:	11.5	1.5
Parallax	0″.00003	0″.000003	0″.005
Absolute photographic magnitude	—14	—11	—5
Diameter in parsecs	80	60	1

The tabulated values illustrate how gigantic these distant nebulae are relative to the Orion Nebula. N. G. C. 5195, a similar large irregular nebula, probably gaseous, is found associated with one of the spiral arms of Messier 51.

Harvard College Observatory Bulletin 816. (H. S.)

The Absolute Magnitudes and Parallaxes of 1105 Stars.— The Dominion Astrophysical Observatory of Victoria, B. C., has just issued a valuable contribution on this subject by Drs. R. K. Young and W. E. Harper. The material involved the spectrograms taken for other purposes as well as those specially taken for this investigation. The spectrograms were taken with a one-prism spectrograph attached to the 72-inch reflector of the observatory. The method is that of spectroscopic parallaxes. This method, as is well known, involves the comparison of the relative strength of certain lines in the spectra of the stars and whose intensities depend upon the absolute magnitude of the star. When the absolute magnitude is thus found and the apparent magnitude determined by direct observation a simple formula permits the calculation of the parallax. A total of fourteen lines in the stellar spectra were used. The agree-

ment between these parallaxes of the Dominion Astrophysical Observatory and those of the Mt. Wilson Observatory are very satisfactory.

Recent Solar Constant Values.—Dr. C. G. Abbot of the Smithsonian Institution has just published the provisional results of the solar constant determinations made at the two stations of the Institution at Mount Harqua Hala

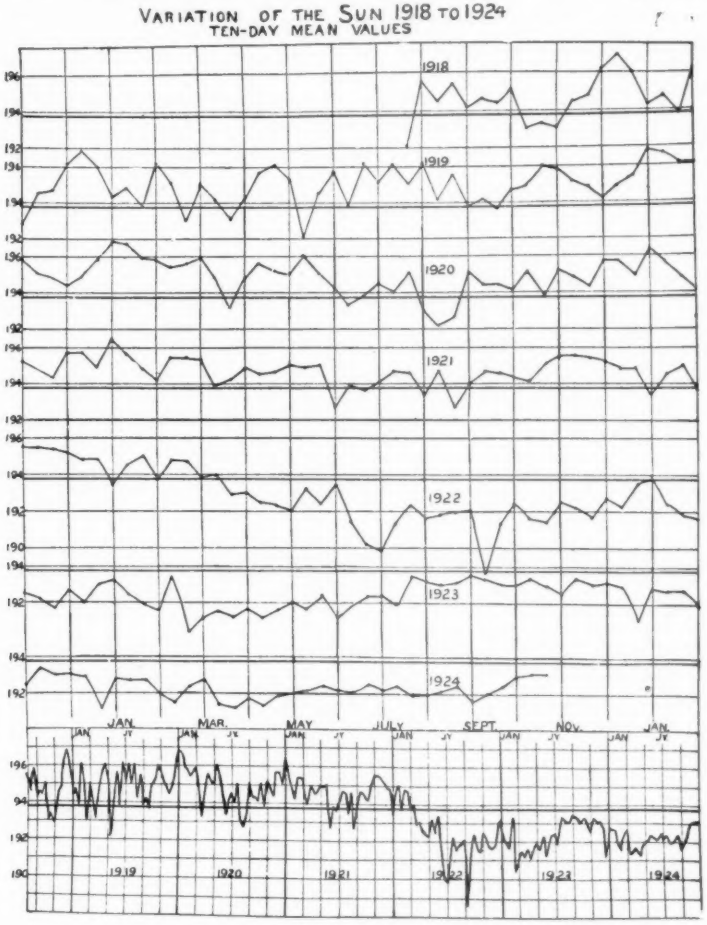


FIG. 1.

in Arizona and Mount Montezuma in Chile. Figure 1 gives the results in graphic form. The high values of the earlier years indicate why we had such hot summers and mild winters while the low values in 1923 and 1924 likewise supply a good reason for low mean temperatures of those years. The material thus available is being studied by Mr. H. H. Clayton to determine its relation to changes

of weather and climate. It is stated that these studies will soon be published.

Figure 2 shows the relation of solar constant values and the Wolf sun-spot

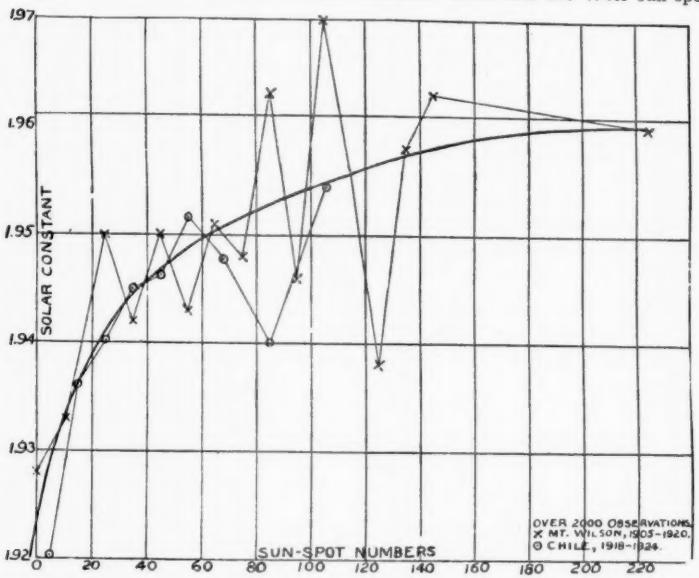


FIG. 2. Increased solar activity brings higher solar constant values.

numbers. It shows clearly that increased solar activity, as indicated by the number of sun spots, is accompanied by an increase in the value of the solar constant.

Meteors, by Charles P. Olivier, Ph. D., 276 pp., $6.00; Williams & Wilkins Co., Baltimore, 1925.

This book, written by the leading meteor observer in the country, fills a long-felt need. It contains a thorough discussion of the principal facts concerning meteors together with the formulae and full details for the computation of meteor orbits. There are many references to the important papers on the subject. The author states his own views frankly and the reasons why he does not agree with other authorities on some points. The book is well printed, with ample margins, and well bound. It deserves a place in every astronomical library as well as in all general libraries.

Time Measurement, L. Bolton, M. A., 165 pp.—D. Van Nostrand Company, New York, $2.00.

This little volume treats its subject under the following thirteen chapters: The nature of time measurement; the year; the day; time-pieces; 13th and 14th century clocks; Galileo and Huygens; Hooke, Graham, and Harrison; striking mechanism; driving mechanism; watches and chronometers; electric clocks; Greenwich mean time; the calendar. It is written in simple terms and is intended for the general reader who desires to know the elements of the subject without going into the technical side. The book can be recommended.